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En Route Operational Errors: Transfer of Position Responsibility as a Function of Time on Position

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16. Abstract

Operational Errors (OEs) can occur anytime while a controller is on position. However, the historical trend has been that a higher percentage of OEs occur early on position and then tapers off as on-position time increases. This trend has been consistently observed across the different air traffic options and time of day. Past efforts at reducing OEs that occur early on position have focused on improvements associated with the position relief briefing. Despite these efforts, nothing has been able to reverse the trend in OEs. We conducted a retrospective analysis of enroute OEs to determine if there were human factors considerations unrelated to the position relief briefing checklist that may explain why OEs occur early following a position transfer. Our results suggest that position transfers differ by type (replacement vs. providing workload reduction) and the amount of time available (time pressure vs. no pressure). Moreover, the human factors considerations differ between the type of transfer and the amount of available time. Although the position relief briefing checklist is well grounded in human factors principles, the checklist itself is insufficient for assessing the various states of mind a controller is operating under immediately following a position transfer.

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INTRODUCTION

Schroeder, Bailey, Manning, and Pounds (2006) recently reviewed the available literature on the human causal factors associated with air traffic control (ATC) operational errors[1] (OEs) and mitigation strategies that have been implemented over 45 years, between 1960 and 2004. One of the findings of the literature review was that a relatively high percentage of OEs occurred during the first ten minutes on position, and that relationship was consistent across options (i.e., en route, TRACON—defined as terminal radar control—and tower), years, and time of day. Furthermore, past OE reduction initiatives have often focused on the position relief briefing (PRB), which occurs during the transfer of position responsibility, as a means of reducing OEs that occurred early on position. Despite past OE reduction efforts, the first ten minutes on position continue to record the highest percentage of OEs, compared with any other ten-minute interval. Unfortunately, we do not know whether further improvements need to be made to the position relief process or whether factors unrelated to the transfer of position are responsible for the high percentage of OEs occurring early on position because there is no documentation reporting evaluations of past OE reduction efforts. To help clarify this issue, we conducted a retrospective study of the Federal Aviation Administration OE database.

Our study was part of a larger time vulnerability research (TVR) effort that included an examination of OEs based on time of day, time since start of shift, and time on position. The TVR program was created to support the FAA Air Traffic Organization's (ATO's) performance goal of reducing the number of Category A and B (most serious) OEs to no more than 563 by FY09, equivalent to a rate of 3.18 OEs per million activities (FAA, 2005). At the end of FY07 the number of OEs was 617.

Before we introduce our study, we first summarize a selected review of the literature about OEs that occur early on position and follow that with an overview of the transfer of position processes. Finally we discuss the important elements of the OE investigation process as they relate to the transfer of position responsibility.

[1]An OE occurs whenever separation minima between aircraft are compromised as a result of a controller's actions or inaction.

Selected Review of OEs Early on Position

As previously noted, past research on OEs that occur early on position has produced similar findings. In an analysis of the NAIMS (National Airspace Incident Monitoring System) OE database, Lowry et al. (2005) found that approximately 15% to 18% of all OEs occurred in each of the first three ten-minute intervals following a position change. The results were similar for en route, TRACON, and tower facilities. As shown in Figures 1a and 1b, we obtained similar results when we plotted the distribution of en route OEs for the three-year period (June 1, 2001 – June 1, 2004) covered by our study.

Despite the consistency of their findings, Lowry et al. (2005) found it difficult to fully interpret the implications of the results without knowing the average time controllers spend on position. That is, without comparing the time on position distribution of OEs with the number of "signs-on" and "signs-off"[2] occurring over the same time intervals, it was not possible for Lowry and his colleagues to determine whether the OE distribution was the result of exposure effects or whether other factors affecting controller performance influenced the distribution of OEs. Concerning the latter, Lowery et al. offered two possible explanations for OEs occurring early on position— either the position relief briefing (PRB) was inadequate or the controller assumed the position during a busy traffic period. In addition to traffic volume, Schroeder et al. (2006) offered a possible alternative explanation to Lowry's by suggesting that a portion of OEs occurring early on position could be attributed to the controller "getting the picture" or "getting up to speed" when taking over a position. Another possibility was that additional information, that as yet remains unknown, may need to be communicated to a controller who assumes a position. In either case, analysis of recorded OE data clearly demonstrated that the tendency for a high percentage of OEs to occur early on position has been consistent for the past two decades. However, there was little evidence to document the extent to which the PRB played a prominent factor in their occurrence.

One reason for the lack of evidence may be due to the nature of the position relief process. Much of what occurs during the transfer of position is mental and is not subject

[2]A controller "signs-on" to a position to indicate that he/she has accepted position control responsibilities. A controller "signs-off" to a position to indicate that he/she has relinquished control of position responsibilities.

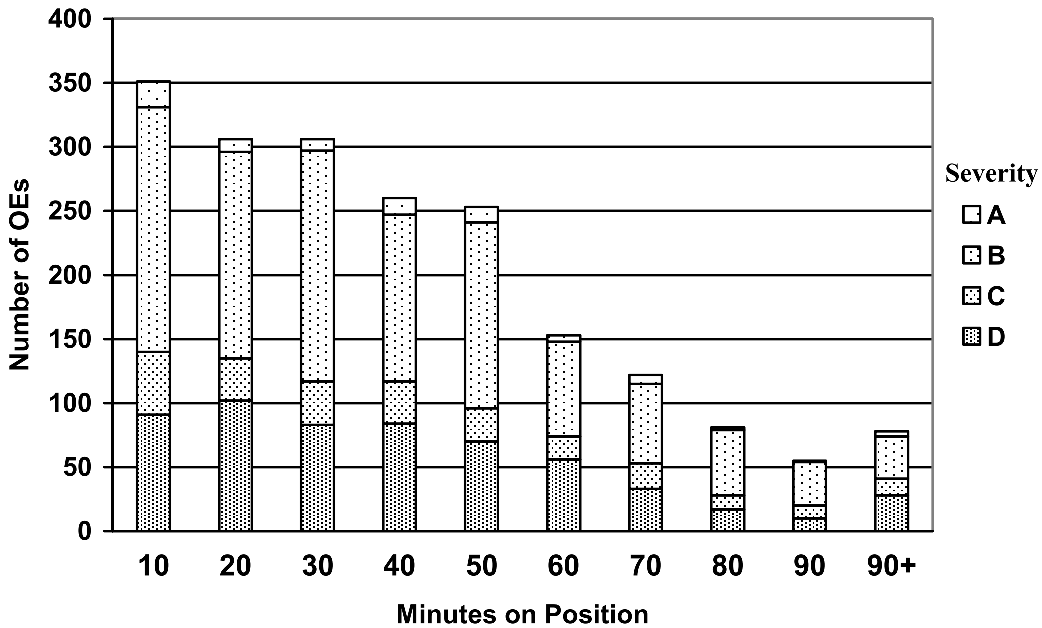

Figure 1a. Number of En Route OEs by Time on Position and Severity

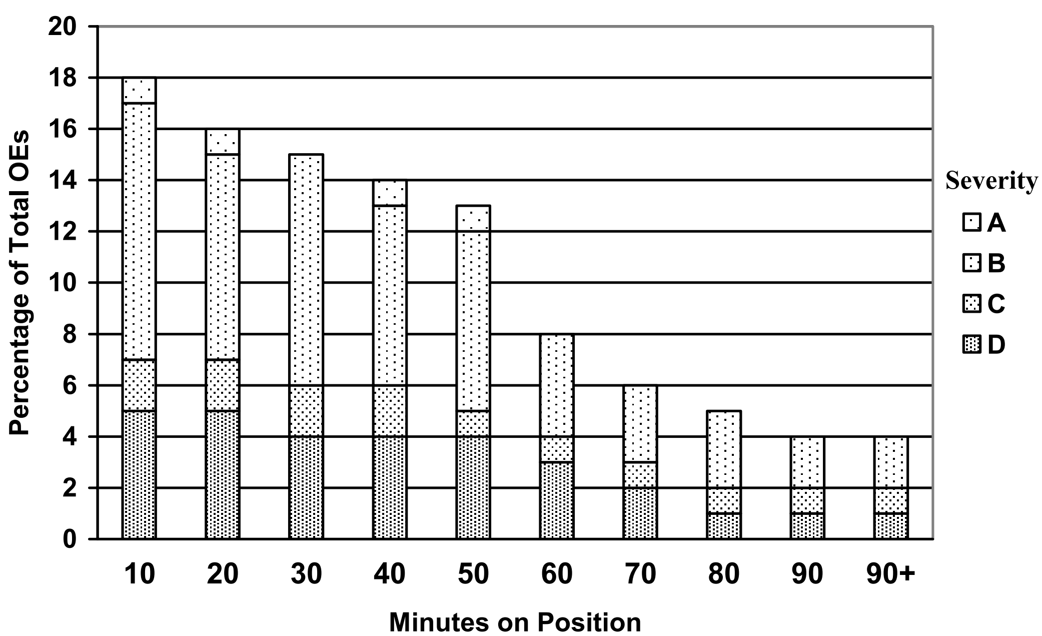

Figure 1b. Percentage of En Route OEs by Time on Position and Severity

to direct observation. Thus, when OEs occur early on position, it is difficult to obtain objective indicators of how the position relief process may have contributed to the OE. The importance of the mental tasks associated with an effective transfer of position is highlighted in FAA Order 7110.65 (FAA, 2006a). We present a brief overview of the Order with particular emphasis on the standard operating procedures (SOPs) for ensuring a safe and efficient position relief transfer.

Transfer of Position Process

Each air traffic facility is required to develop a position relief checklist that covers the following steps: (a) pre-transfer review of the position by the incoming controller (i.e., the relieving controller), (b) the recorded verbal briefing conducted by the outgoing controller (i.e., the controller being relieved), (c) the assumption of position by the incoming controller, and (d) post-transfer review of the position by the outgoing controller. When an OE occurs, the recorded PRB is examined to ensure that the relevant aspects of the traffic situation (as listed in Table 1) were covered.

However, there is more to the position relief process than the verbal exchange of information. For example, if the outgoing controller is to accurately brief the replacement, it is important that the mental picture on which the briefing will be based accurately reflects the traffic situation. Similarly, for the incoming controller to be ready to assume control of the traffic, it is important to have an accurate mental picture of the traffic situation. If there are inaccuracies in either of their mental pictures, then the position relief process is flawed. Because it is difficult to make judgments about whether a controller is mentally ready to assume control of a position, the assumption has been that if the verbal briefing of the outgoing controller is complete and accurate, then the relieving controller will be mentally ready to take over the position. Although we agree that a verbal briefing is a necessary condition for preparing the relieving controller, it alone is not sufficient. We will further illustrate this point by looking at the position relief process from the perspective of the incoming radar controller operating within an en route facility.

Figure 2 is an idealized model for how an incoming controller develops a mental picture of actual traffic conditions prior to assuming control of the sector. The model was developed by EUROCONTROL human factor researchers to depict both the behaviors and the mental tasks associated with performing a position relief transfer (Kallus, Van Damme, & Dittmann, 1999). Because Figure 2 is an idealized depiction of the transfer of position process, it is provided for heuristic purposes only.

Consistent with FAA Order 7110.65, the position relief process (Figure 2) begins with the incoming controller engaging in a series of activities designed to develop a preliminary mental picture of the traffic situation. First, the incoming controller recalls what the sector looks like under normal conditions. This information is based on examining the sector maps as well as recalling past experiences with working the sector. The controller then updates this *static* mental image with the information obtained from reviewing the materials at the Status Information Area (a location designated within the radar control room that provides the latest information/updates relevant to sectors within a given area of specialization).

Next, the incoming controller in our idealized model scans the radar display, flight progress information (either in electronic or paper form), and observes the controller in action. During this time period, the incoming controller's static mental picture expands into a *dynamic* view. Depending on the circumstances, the incoming controller may formulate a number of working hypotheses about what is going on with the traffic on the radar display. These hypotheses may then be reinforced or modified based on the content of the verbal briefing. It is important to note that the verbal briefing itself does not guarantee that any hypothesis testing occurred. The briefing just increases the likelihood that some form of hypothesis testing takes place.

Table 1. Topics Covered by Verbal Position Relief Briefing

• Special Activity Aircraft	• Nonradar operations
• Point out aircraft	• VFR advisory aircraft
• Holding aircraft	• Aircraft standing by for service
• Primary targets with no associated alphanumerics	• Coordination agreements with other positions
• Aircraft handed off but still in the airspace	• Special problems, requests, or instructions
• Aircraft released but not yet airborne	

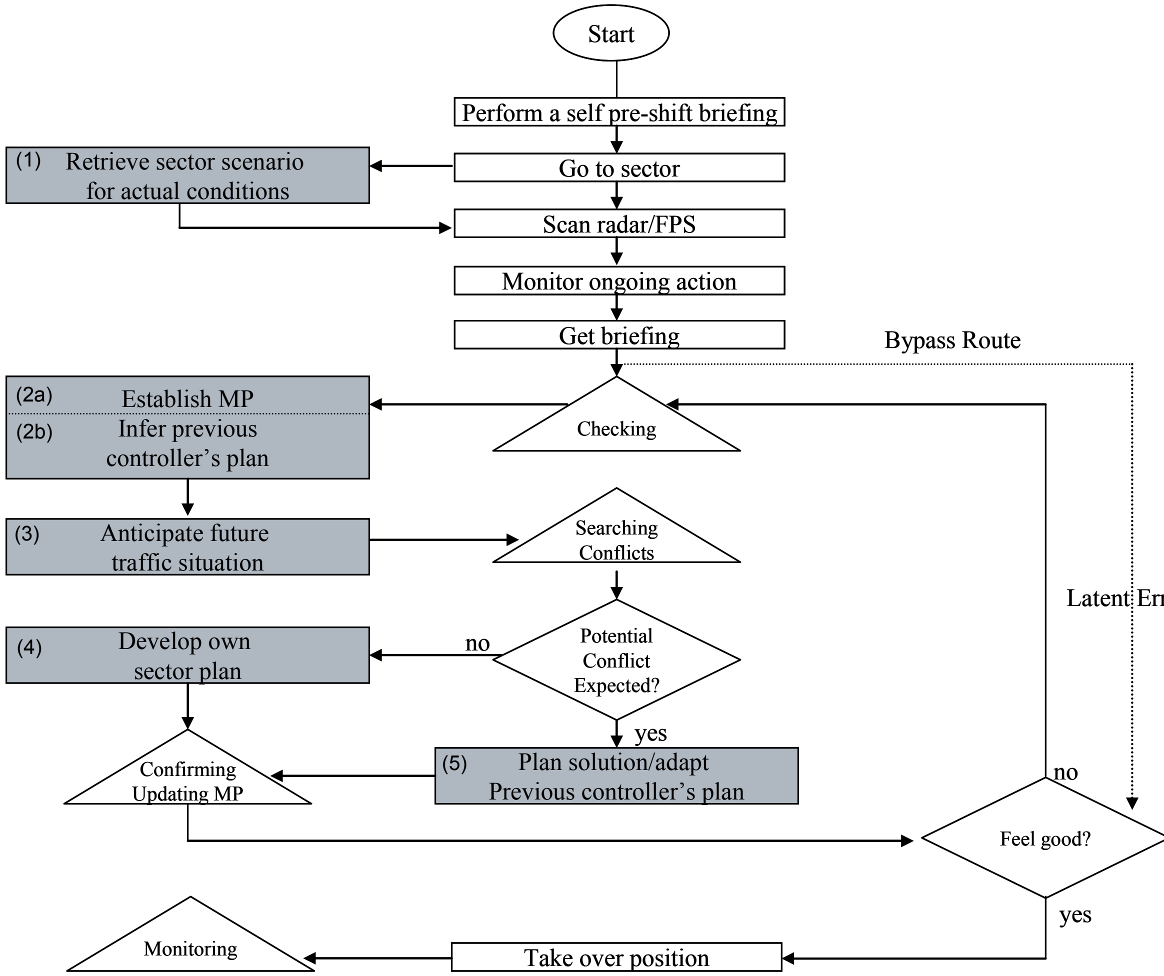

Figure 2. Idealized Model of the Mental Tasks Associated With an En Route Radar Controller During a Position Transfer (Adapted From Kallus et al., 1999)

At the time of the verbal briefing, the mental task (Fig. 2 Box 2a) of the idealized incoming controller is to update the mental picture he/she has of the sector traffic with information included in the position relief briefing. It is also important that the incoming controller uses the briefing information to develop a sense of the sector management strategy currently employed by the outgoing controller (Box 2b). By first understanding the logic behind the outgoing controller's sector plan, the incoming controller reduces the likelihood of missing the ramifications embedded within the sector plan (such as a specific aircraft needing to be turned sometime within the next ten minutes). Unfortunately, it is during this time period that the incoming controller can short-circuit the position transfer process by failing to understand the outgoing controller's perspective. This is illustrated as the by-pass route shown in the idealized model in Figure 2.

At the time of the verbal briefing the incoming controller has been thinking about the situation that will be faced once assuming sector traffic control. Thus, depending on the circumstances, rather than first seeing the sector through the eyes of the outgoing controller, the incoming controller might simply bypass that process and, instead, develop an intuitive "feel" for the sector traffic based on past experiences with working it. Since the intuitive feel of the incoming controller may not match the intent of the outgoing controller's sector management plan, it is possible that the incoming controller will assume control of the sector without understanding the implications associated with the outgoing controller's sector management plan.

This problem is minimized when the incoming controller does not by-pass the processes associated in our idealized model with Boxes 2 through 5.

As shown in Box 3, once the incoming controller has seen the current traffic situation from the perspective of the outgoing controller, his/her next mental task is to project into the future to determine what the traffic situation might look like if the outgoing controller's plan continues (recall that this may take only a few moments). This type of mental projection allows the incoming controller to identify potential traffic conflicts about which the outgoing controller failed to brief. If no non-briefed conflicts are projected to occur, then the incoming controller is ready to convert/adopt the outgoing controller's sector plan into one of his/her own (Box 4). However, if a potential traffic conflict is identified but was not included in the briefing, the incoming controller must point it out. The incoming and outgoing controller must then decide whether the conflict needs to be resolved before or after the transfer of position occurs. If the conflict is going to be resolved after control is assumed, then the incoming controller needs to develop a plan of action for addressing it (Box 5).

Although not shown in Figure 2, FAA Order 7110.65 further advises that after the transfer of position responsibility, the outgoing controller should monitor the incoming controller's actions long enough to determine that sector safety has not been compromised. As pointed out earlier, the amount of time spent on performing these tasks is left to the professional judgments of the involved controllers. However, as a general rule, the time spent monitoring the incoming controller's performance is short (i.e., less than 30 seconds).

Based on the above discussions one might think that the amount of time dedicated to the position relief process would serve as a surrogate measure for the depth to which the incoming controller has processed the information received. However, time by itself is not a sufficient indicator of the depth of mental processing. The amount of time an individual spends on the mental tasks shown in Figure 2 varies as a function of the individual and the complexity of the traffic situation. Some controllers can process information faster than others. Similarly, some traffic situations are so simple that there is little information to process. On the other hand, additional mental resources may be required when a sector has numerous crossing patterns involving ascending and descending aircraft at the time of the position transfer. Thus in the end, the amount of time needed for a safe and effective position transfer is left to the judgment of those involved.

OE Investigation Process

When an OE occurs, a preliminary investigation (as described in Appendix A) is conducted to determine whether the OE was the result of a controller action (or inaction), an equipment malfunction, or some other factor that was not under the direct control of the ATC specialist. If the preliminary investigation reveals that the OE probably occurred because of controller human error, then a formal investigation (Appendix B) is conducted to determine what controller actions or inactions caused the OE. As part of the formal investigation process, voice recordings for the relevant verbal position relief briefing are reviewed to determine whether: (a) a checklist was used during the briefing, (b) the briefing was complete, and (c) the incoming controller made use of the pertinent data exchanged during the briefing.[3] Notice that what is lacking from this list is an assessment of whether the incoming controller had an accurate mental representation of the traffic situation prior to assuming control of the traffic. Although recorded data are not available to allow us to assess this directly, we may be able to assess it indirectly.

One way of testing whether a radar controller was mentally ready to assume control of a sector is to think about the consequences of not being ready. If a radar controller was not mentally ready, we can conclude that he/she would not perceive and/or fully understand the information presented on the radar display. In other words, the radar controller would lack situation awareness (SA).

Although the SA construct is well documented in the safety literature, definitions vary across occupational domains (c.f., Banbury & Tremblay, 2004; Endsley & Garland, 2000). The definition most applicable to air traffic control is the one proposed by Endsley (1999). She defines SA as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (p. 97). Notice that there are three elements in Endsley's definition: (a) detection, (b) comprehension, and (c) projection. All three are assessed during the formal OE investigation process, at least to the extent they are related to performing radar display activities (see Block 68 of FAA form 7210-3, Appendix B). Thus, the three SA elements provide a basis for determining whether an incoming controller was mentally ready to assume control of the traffic at the time of the position transfer. If the incoming controller was ready to assume control of the traffic, we would expect that a lack of SA would not be a factor in OEs that occurred early on position. In contrast, if the incoming controller

[3]This information is reviewed as a matter of policy regardless of whether the transfer of position responsibility is thought to be an OE causal factor.

was not mentally ready to assume traffic control, then we would expect that a lack of SA would be associated with OEs that occurred early on position. Given that we have identified measures to assess the content and use of the verbal briefing as well as the mental readiness of the relieving controller, we can now return to our stated purpose.

Transfer of Position Study

The goal of our study was to identify human factors causes of OEs that occurred early on position. Our emphasis was on the time period shortly following the transfer of position responsibility. In addition to material derived from Block 68 of form 7210-3, we examined the "Summary of Incident" narratives (Block 65) for human factors causes of OEs related to the position relief briefing and/or those OEs that occurred as a result of a lack of SA early on position.

The hypotheses guiding our research were:

H_1: The frequency distribution of OEs related to the position relief briefing will be positively skewed. That is, when plotted across time on position, a higher number/percentage of OEs will occur early on position and then will taper off across time.

H_2: The frequency distribution of OEs related to a lack of SA will be skewed in the positive direction. That is, when plotted across time on position, a higher number/percentage of SA-related OEs will occur early on position as compared to later on position.

METHOD

OE Sample

The OE database used for this analysis included information recorded about the controller who was primarily responsible for the OE. This information contained all variables listed on Forms 7210-2 and 7210-3 for the 3-year period (June 1, 2001 through June 1, 2004). Of particular interest were variables related to time on position and OE severity, PRB, and SA (Table 2).

We extracted all en route OEs that had been assigned an OE Severity Index (SI) rating. The OE SI rating process was implemented by the FAA in 2001 to describe the amount of safety risk associated with an OE. Points are assigned for varying amounts of vertical separation, horizontal separation, closure rate, flight paths, and to indicate whether the controller was aware that an OE was developing prior to its occurrence (Bailey, Schroeder, & Pounds, 2005; FAA, 2006a). Each OE is assigned one of four severity classifications based on the number of accumulated points (FAA, 2006a):

1) Category A, high severity, assigned 90 points or higher.
2) Category B, high-moderate severity, assigned 40-89 points AND determination that the controller was *unaware* that the OE was occurring.
3) Category C, low-moderate severity, assigned 40-89 points AND determination that controller was *aware* that the OE was occurring.
4) Category D, low severity, assigned 39 points or less.

The extraction resulted in 1, 965 OEs that were distributed across the following SI categories: (a) Category A – 83(4%), (b) Category B – 1061 (54%), (c) Category C- 247(13%), and (d) Category D – 574(29%). We used this extraction to create two additional datasets, a PRB dataset, and a Radar SA dataset (see Table 3).

From the OE SI extraction we created a PRB data set consisting of only those OEs in which the PRB was marked as a causal factor in block 68 of Form 7210-3. A total of 455 OEs (23% of the original OE SI extraction) populated this data set and were distributed across the four SI categories as follows: (a) Category A -17(4%), (b) Category B – 260(57%), (c) Category C – 49(11%), and (d) Category D – 129(38%).

The Radar SA data-set consisted of those OEs for which various aspects of Radar SA were marked in block 68 of Form 7210-3. A loss of Radar SA was reported in 1375 OEs (69% of the original OE SI extraction) that were distributed across the following SI categories: (a) Category A -50(4%), (b) Category B – 644(47%), (c) Category C – 191(14%), and (d) Category D – 490(35%).

Table 2. OE Database Samples for the Period June 1, 2001 to June 1, 2004

	Database Extractions					
	OE SI		Position Relief Briefing		Radar SA	
	N	Pct.	N	Pct.	N	Pct.
Category A	83	4	17	4	50	4
Category B	1061	54	260	57	644	46
Category C	247	12	49	11	191	14
Category D	574	30	129	28	490	36
Total	1965	100	455	100	1375	100

Instruments

FAA Form 7210-3 (see Appendix B). If the results of the preliminary investigation validate that an OE occurred, the facility's air traffic management (ATM) designates an Investigator-In-Charge (IIC) to conduct a formal and more thorough analysis of the human factors causes of the OE. Among other things, this requires identifying whether the following human error elements contributed to the OE: data posting, use of the radar display, aircraft observation (for towers only), pilot-controller communications, controller-controller coordination, and position relief briefings (Table 3). In addition, the IIC is required to write a detailed chronological summary of the incident and explain why the controller did not maintain separation. The data collected during the formal investigation are recorded on FAA Form 7210-3 and entered into the FAA's OE database.

Variables of Interest

Time on Position (Block 25 of Form 7210-3) – This refers to the elapsed time, expressed in minutes, between when the controller signed on a position and when the OE occurred.

Summary of Incident (Block 65) – This is a text field that describes the chronological order of events and the controller's actions or lack of action that caused the OE.

Position Relief Briefing (Block 68) – When an OE occurs as the result of some aspect of the position relief briefing, the PRB box is checked YES, and then four additional options are presented to provide greater specificity. The IIC checks all options that apply:

1) PRB1 - Employee did not use the position relief briefing checklist.

Table 3. Definitions of OE Causal Factors

Data Posting Errors. A data posting error is any error of calculation, omission, or incomplete data, erroneous entries, handling, or subsequent revisions to this data. This includes errors in posting and recording data. It does not include errors involved in receiving, transmitting, coordinating, or otherwise forwarding this information

Radar Display Errors. Radar display errors included the misidentification and/or the inappropriate use of displayed data. Radar misidentification means a failure to properly identify the correct target and includes subsequent errors committed after the original identification was properly accomplished. A data or display information error occurs due to a failure to maintain constant surveillance of a flight data display or traffic situation and to properly use the information presented by the display or situation.

Aircraft Observation Errors (Tower Only). An aircraft observation error means a failure to maintain constant surveillance of aircraft and the movement area, and to properly react to, interpret, or otherwise utilize, in a timely manner, the information being viewed.

Communication Errors. A communication error is a causal factor associated with the exchange of information between two or more people. It refers to the failure of human communication and not communication equipment. Causal factors that are most identified in communication errors include: (a) improper phraseology, (b) transposition of information, (c) misunderstanding, (d) failure to identify improper or incorrect read back of information, and (e) the lack of the acknowledgment of information sent or received.

Coordination Required Errors. Coordination errors refer to any factor associated with a failure to exchange requirement information. This includes coordination between individuals, positions or operation, and facilities for exchange of information such as APREQs, position reports, forwarding of flight data, etc.

Position Relief Briefing Errors. Relief briefing errors are special errors of both communication and coordination, which occur as the result of position relief. These include such things as failure to give a relief briefing, failure to request a briefing, incomplete or erroneous briefing, etc.

2) PRB2 - Employee being relieved gave an incomplete briefing.
3) PRB3 - Relieving employee did not make use of pertinent data exchanged during briefing.
4) PRB4 - Other (explain).

If the PRB box was marked YES without one of the four additional items marked YES, then we referred to the OE as a *PRB OE*. If the PRB box is marked YES and one or more of the four items are marked as YES, then we referred to the OE as a *block 68 PRB OE*. As will be explained later in this report, block 65 and block 68 PRB OEs are subsets of the total number of PRB OEs.

Radar SA (Block 68) – This variable describes OE causes associated with the inappropriate use of the radar display. The IIC marks all that apply:
1) Failed to detect displayed data, or
2) Failed to comprehend displayed data, or
3) Failed to project future status of displayed data.

Definition of Terms. The following are brief definitions of ATC terms used in the remainder of this report.
1) Radar Controller (R-side) – The controller primarily responsible for communicating with pilots and ensuring aircraft separation.
2) Radar Associate/Data Controller (D-side) –The controller who assists the R-side by managing flight data progress updates and coordinates with other controllers in other sectors.
3) Tracker/Handoff (T) – The controller who assists the R-side by coordinating handoffs of aircraft from one sector to the next.
4) Splitting Positions (SP) – When part of a controller's position responsibilities are assumed by another controller.
5) Splitting Sectors (SS) – When a sector is divided into two or more smaller sectors.
6) Combining Positions (CP) – When a controller takes on the position responsibilities of controller(s) working at all other positions in the same sector.
7) Combining Sectors (CS) –When two or more smaller sectors are combined into one.

Procedures

Two data sets, as previously described, were constructed for this study. Data for the PRB data set were extracted using SPSS 14.0 for Windows. OE cases were included if Block 68, PRB, or if any of the four category statements were marked YES. The number of PRB OEs was plotted in ten-minute intervals across time on position. Statistical comparisons were made for selected time intervals.

The incident summaries from PRB OEs were then examined to identify additional human factors causes. A total of eight en route ATC subject matter experts (SMEs) with at least 15 years of ATC experience examined selected OE narratives to determine:
1) the positions involved in the OE (i.e.,., Radar, Radar Associate, Tracker/Handoff, or Supervisor),
2) why the OE occurred (lack of controller awareness, failure to brief, or failure to use briefed information), and
3) the human factors causes associated with #2 (e.g., forgetting, distractions, time pressure).

Other than the three topic headings, no coding categories were provided. Thus, the SMEs were free to interpret the narratives as they wished so long as they provided documented evidence to support their conclusions. This information was used to supplement findings from the analyses of the PRB dataset.

In the Radar SA dataset, OE cases were included if any of the Block 68 (Appendix B) Radar Display SA statements were marked YES. Radar SA OE frequencies were plotted in ten-minute intervals across time on position. These data were then combined with the PRB dataset to identify OEs that included both a PRB-related causal factor and a Radar SA-related causal factor. Statistical comparisons were made for selected time intervals. The incident summaries of OEs that included both a PRB-related causal factor and a Radar SA-related causal factor error were then examined to identify the human factors causes.

RESULTS

PRB OEs

Figure 3a shows the distribution of the percentage of PRB OEs by time on position and broken down by SI category. As expected, the distribution was skewed in the positive direction with the highest percentage of OEs (21%) occurring during the first ten minutes and then decreasing in a stair-step fashion with increasing time on position. The distribution for the percentage of Categories A&B PRB OEs (the most severe) and Categories C&D PRB OEs (the least severe) are shown separately in Figures 3b and 3c, respectively. Additional information about the number and percentage of PRB OEs is presented in Table 4.

When the profiles of Figures 3a and 1b were compared, we saw that the distribution of PRB OEs was similar to the distribution of all OEs. This was a curious finding because, historically, PRB OEs were thought to be a problem that primarily occurred early on position. However, it was clear from the comparison that PRB OEs, like OEs in

general, were spread out across time on position. To better understand why this might be the case, we conducted a more detailed analysis of PRB OEs.

The distribution of the three variables for the block 68 PRB items (listed in the Variables of Interest Section) was examined across ten-minute intervals. Unfortunately, of the 455 position relief briefing OEs recorded, only 30 (6.6%) of them included markings for at least one of the PRB items. Because of the lack of data, we convened a panel of ATC SMEs to examine the summary of incident reports for any additional information about the PRB OEs.

Of the 455 summaries examined, only 74 (16%) included a reference to the position relief briefing. Of these 74 summaries, the SMEs identified an additional 11 OEs for which no block 68 PRB information was identified. This raised the total from 30 to 37 (8.1%) of the PRB OEs with some form of additional information about why the PRB was viewed as a causal factor. Throughout the remainder of this report, we will refer to these 37 OEs as "Block 68 PRB OEs." The time on position distribution for the Block 68 PRB OEs is shown in Figure 4 and detailed in Tables 5a and 5b. Also, in passing, we noted that 11 of the 37 Block 68 PRB OEs included no mention of the PRB in the accompanying incident summaries. This meant that although PRB details were marked, they were not discussed in the summaries.

Figure 4 shows the distribution of the percentage of Block 68 PRB OEs by SI category across time on position. Notice that slightly more than 50% of these Block 68 PRB OEs occurred within the first ten minutes on position, followed by a marked drop to around 20% between 11 and 20 minutes on position. Afterwards, the percentages of Block 68 PRB OEs fluctuated between 0% and less than 10% for the remaining time on position intervals. Also evident in Figure 4 was that the highest percentages of Block 68 PRB OEs were classified as SI Category B (67.6%), followed by SI Category C (18.9%), and SI Category D (13.5%). There were no Block 68 PRB OEs associated with Category A (the most severe type).

Figure 5 shows the distribution of the Block 68 PRB OEs by type of PRB deficiency (i.e., why the OE occurred) across time on position. The highest percentages of Block 68 PRB OEs were attributed to Incomplete Briefing (38.5%) and Briefed Information Not Used (35.9%). No Checklist occurred 15.4% of the time with the remaining 10% of the PRB OEs being classified as "other." Of particular interest to this study was that during the first ten minutes on position, the percentage of Block 68 PRB OEs were attributed almost twice as often to a failure to use briefed information (23.1%), as compared with a failure to provide a complete briefing (12.8%). In the interval between 11 and 20 minutes on position, the situation was reversed, with twice as many OEs resulting from a failure to provide a complete briefing (10.3%), as

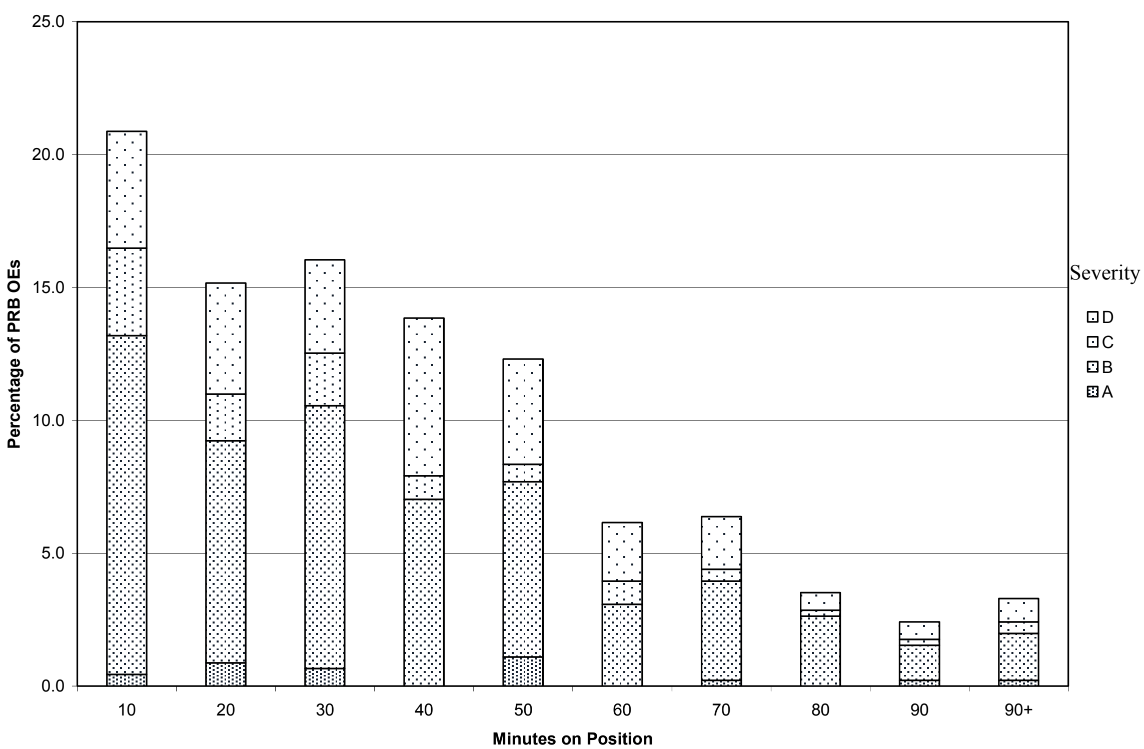

Figure 3a. Percentage of PRB OEs by Time on Position and Severity

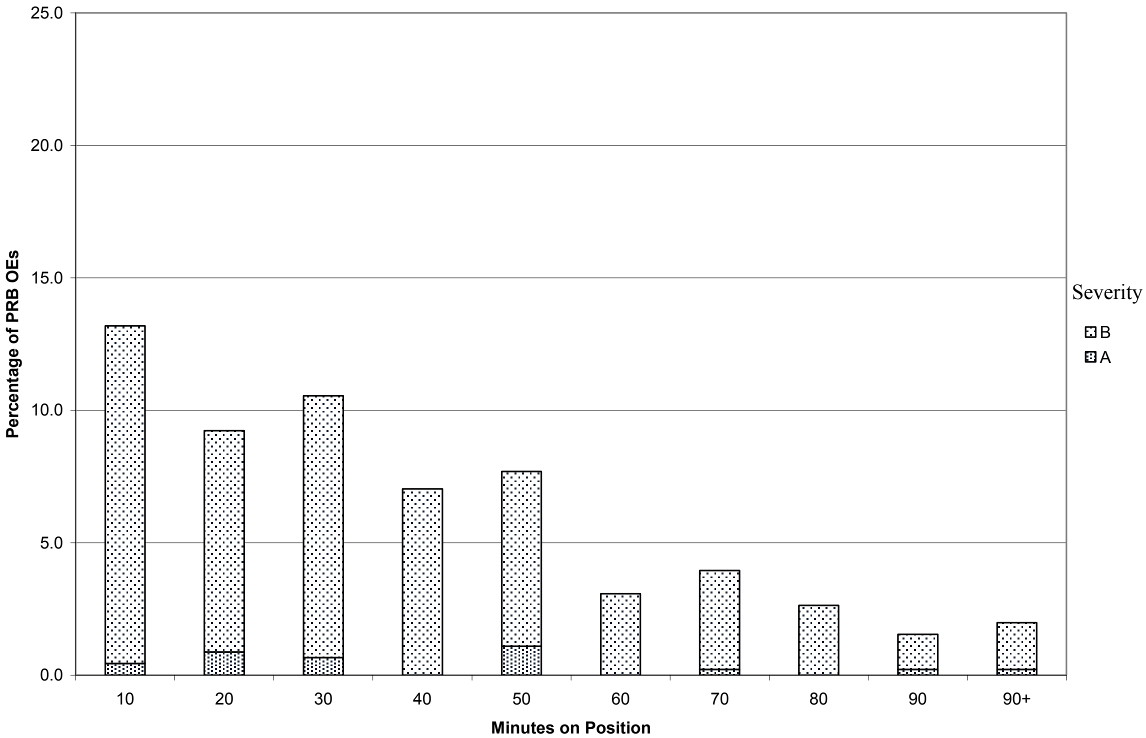

Figure 3b. Percentage of Categories A&B PRB OEs by Time on Position and Severity

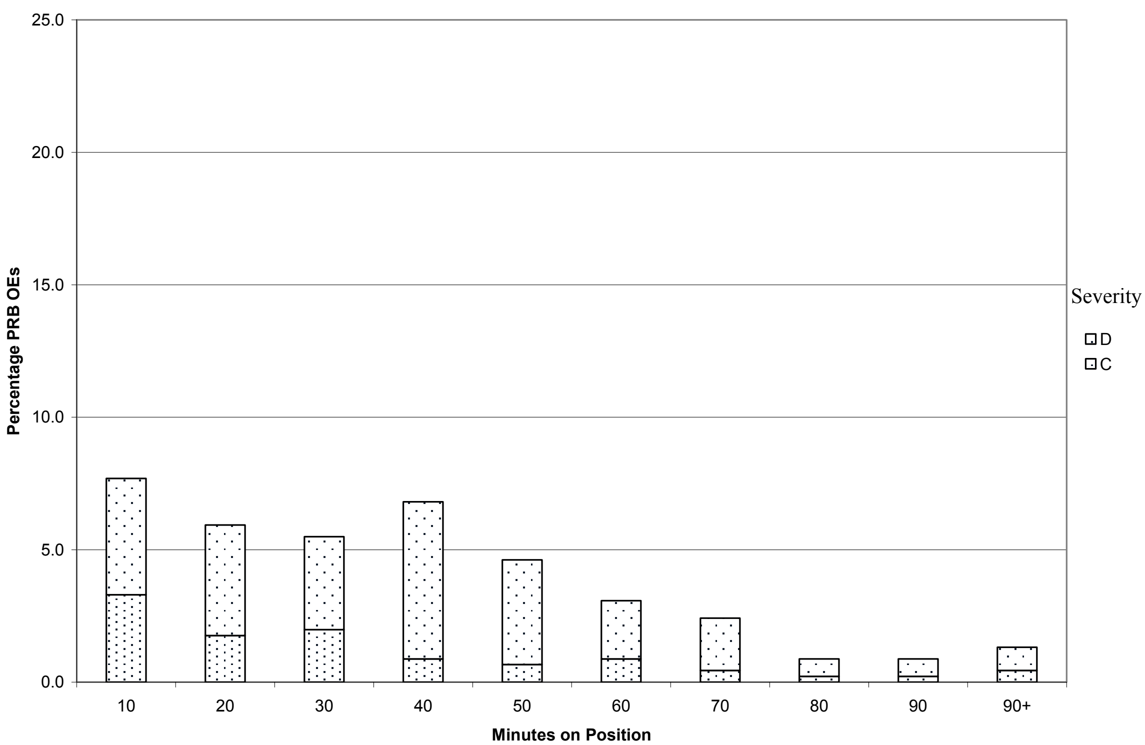

Figure 3c. Percentage of Categories C&D PRB OEs by Time on Position and Severity

Table 4. Number and Percentage of PRB OEs Across Time on Position and OE Severity Index

Minutes on Position	Category A n	Category A %	Category B n	Category B %	Category C n	Category C %	Category D n	Category D %	Total n	Total %
10	2	0.4	58	12.7	15	3.3	20	4.4	95	20.9
20	4	0.9	38	8.4	8	1.8	19	4.2	69	15.2
30	3	0.7	45	9.9	9	2.0	16	3.5	73	16.0
40	0	0.0	32	7.0	4	0.9	27	5.9	63	13.8
50	5	1.1	30	6.6	3	0.7	18	4.0	56	12.3
60	0	0.0	14	3.1	4	0.9	10	2.2	28	6.2
70	1	0.2	17	3.7	2	0.4	9	2.0	29	6.4
80	0	0.0	12	2.6	1	0.2	3	0.7	16	3.5
90	1	0.2	6	1.3	1	0.2	3	0.7	11	2.4
91+	1	0.2	8	1.8	2	0.4	4	0.9	15	3.3
Total	17	3.7	260	57.1	49	10.8	129	28.4	455	100.0

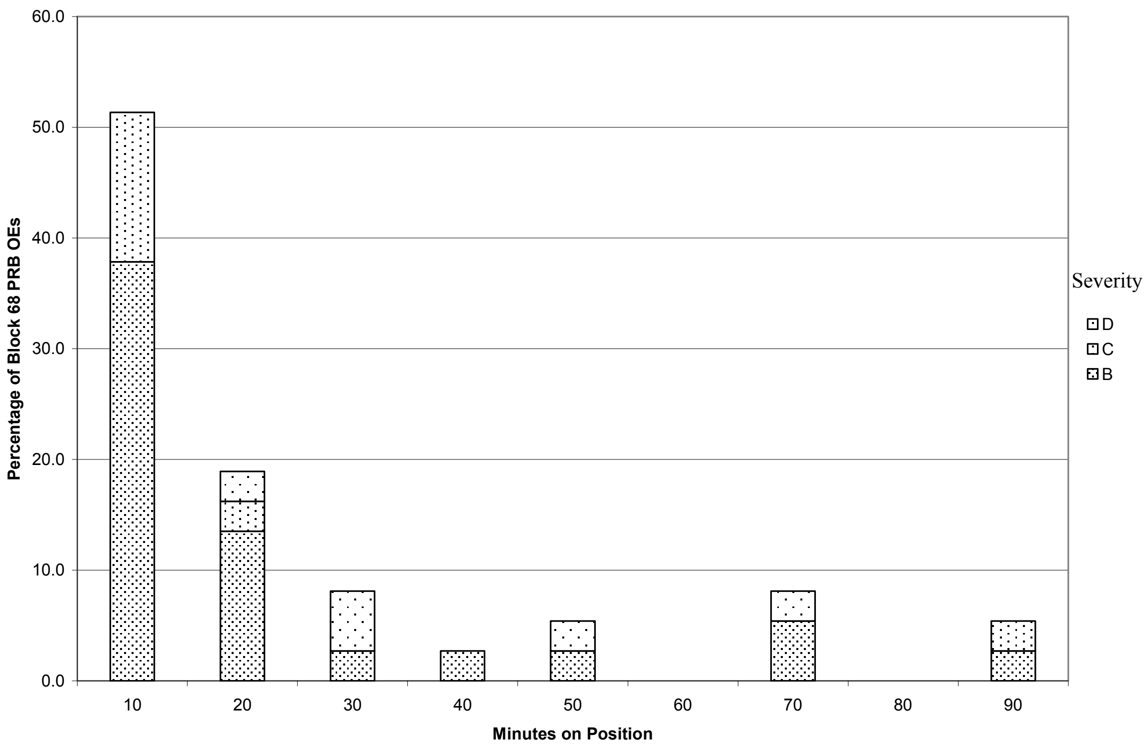

Figure 4. Percentage of Block 68 PRB OEs by Time on Position and Severity

Table 5a. Number of Block 68 PRB OEs* by Time on Position and OE Severity Index

	Category B				Category C				Category D			
TOP	PRB 1	PRB 2	PRB 3	PRB 4	PRB 1	PRB 2	PRB 3	PRB 4	PRB 1	PRB 2	PRB 3	PRB 4
10	3	5	4	3	0	0	5	0	0	0	0	0
20	1	3	2	0	1	0	0	0	0	1	0	0
30	0	1	0	0	0	0	0	0	1	1	0	0
40	0	1	0	0	0	0	0	0	0	0	0	0
50	0	1	0	0	0	0	0	0	0	0	1	0
60	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	1	1	0	0	0	0	0	0	1	0
80	0	0	0	0	0	0	0	0	0	0	0	0
90	0	1	0	0	0	1	0	0	0	0	0	0
Total	4	12	7	4	1	1	5	0	1	2	2	0

*n = 39 due to multiple coding

Table 5b. Percentage of Block 68 PRB OEs* by Time on Position and OE Severity Index

	Category B				Category C				Category D			
TOP	PRB 1	PRB 2	PRB 3	PRB 4	PRB 1	PRB 2	PRB 3	PRB 4	PRB 1	PRB 2	PRB 3	PRB 4
10	7.7	12.8	10.3	7.7	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0
20	2.6	7.7	5.1	0.0	2.6	0.0	0.0	0.0	0.0	2.6	0.0	0.0
30	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.6	0.0	0.0
40	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	2.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	2.6	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
	10.3	30.9	18.0	10.3	2.6	2.6	12.8	0.0	2.6	5.2	5.2	0.0

* n = 39 due to multiple coding

compared to a failure to use briefed information (5.1%). In other words, during the first ten minutes on position, twice as many of the Block 68 PRB OEs were associated with the incoming controller, rather than the outgoing controller. Within the 11 to 20 minute interval, the pattern was reversed. Twice as many of these OEs were associated with the outgoing controller rather than the incoming controller.

The SMEs' examination of the summaries also revealed that there were two types of position relief briefings: those conducted due to replacing one controller with another (which we called "replacement") and those conducted due to one or more controllers being added to the position to provide assistance to another controller (which we called "assistance"). By definition, replacement meant that the controller being replaced was no longer controlling traffic. Assistance meant that other controller positions were added to reduce the taskload of the Radar controller, but the Radar controller was still controlling traffic. As listed in Table 6, replacement briefings took place under three conditions: (a) when one radar controller replaced another at the same position, (b) when the functions of the Radar Associate (RA) position and/or Tracker position were combined into the primary Radar Controller position, and (c) when two or more sectors were combined into a single sector. Assistance briefings took place under two

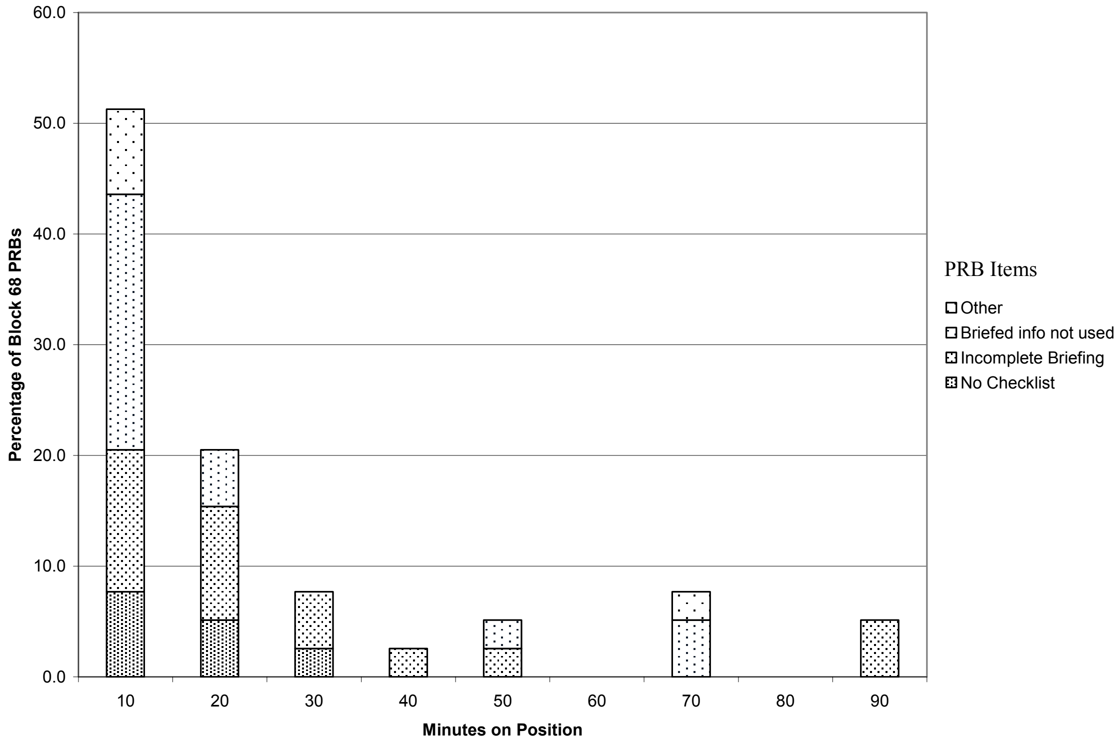

Figure 5. Percentage of Block 68 PRB OEs by Time on Position

conditions: (a) when the functions of the radar controller were split into a RA and/or Tracker position, and (b) when one sector was split into two or more sectors, with each new sector requiring an additional Radar Control position.

Figure 6 and Table 7 illustrate how PRB OEs associated with both replacement and assistance briefings were distributed across time on position. Because of small cell sizes, this information was not broken down by SI categories, and thus, only the composite information is shown. Of the 74 Block 65 PRB OEs, 82.5% were associated with replacement briefings and 17.5% were associated with assistance briefings. The percentage of replacement PRB OEs peaked during the first ten minutes on position followed by a dramatic drop during the second ten-minute interval. In contrast, the highest percentage of assistance PRB OEs occurred during the 30- and 50-minute time on position interval.

Radar SA OEs

Figure 7a shows the distribution of Radar SA OEs by time on position broken down by SI category. As expected, the distribution was skewed in the positive direction. The highest percentage of Radar SA OEs (17.9%) occurred during the first ten minutes on position and then gradually decreased to 12.1% at the 50-minute time interval before dropping off to 8.3% at the 60-minute time interval. Although the values differed, the trend of Figure 7a was markedly similar to that for all OEs, as shown in Figure 2b. The similarity between the two figures is not surprising, given that Radar SA errors were associated with 70% (1375/1965) of all OEs.

Figures 7b and 7c show that the overall pattern was similar for the more severe Radar SA OEs (Categories A&B) and the less severe OEs (Categories C&D). However, in both cases, the highest percentage of OEs occurred during the first ten-minute interval. Additional information about the number and percentage of Radar SA OEs is presented in Table 8.

When the Radar SA dataset was combined with the PRB dataset, we obtained a total of 318 OEs related to both PRB and Radar SA. Thus, 70% (318/455) of all PRB OEs were also associated with a loss of Radar SA. The distribution of Radar SA-PRB OEs across time on position by SI category is shown in Figure 8 and Table 9. The highest percentages of Radar SA –PRB OEs were classified as Category B (48.4%), followed by Category D (34.6%), Category C (13.2%), and Category A (3.8%). As expected, these results were similar to those for PRB OEs in general, as shown in Figure 2 and Table 4.

Because we were interested in understanding the linkage between the loss of Radar SA (as a surrogate measure for not being mentally prepared to release/assume sector

Table 6. Types of Position Relief Briefings

Type of Position Relief	Reason for Position Transfer	Positions Involved*
Replacement		
	Providing a Position Break	▪ R-side is briefed by a replacement R-side. ▪ RA is briefed by a replacement RA
	Combining Positions	▪ R-side is briefed by RA ▪ R-side is briefed by Tracker
	Combining Sectors	▪ Incoming R-side is briefed by R-side whose sector is to be combined.
Assistance		
	Splitting Positions	▪ RA is briefed by R-side. ▪ Tracker is briefed by R-side
	Splitting Sectors	▪ Incoming R-side is briefed by R-side whose sector is being divided.

* R-side (i.e., radar controller) is responsible for providing aircraft separation, RA (radar associate) is responsible for managing data updates and inter-sector coordination, Tracker is responsible for managing data block radar display information and handoffs.

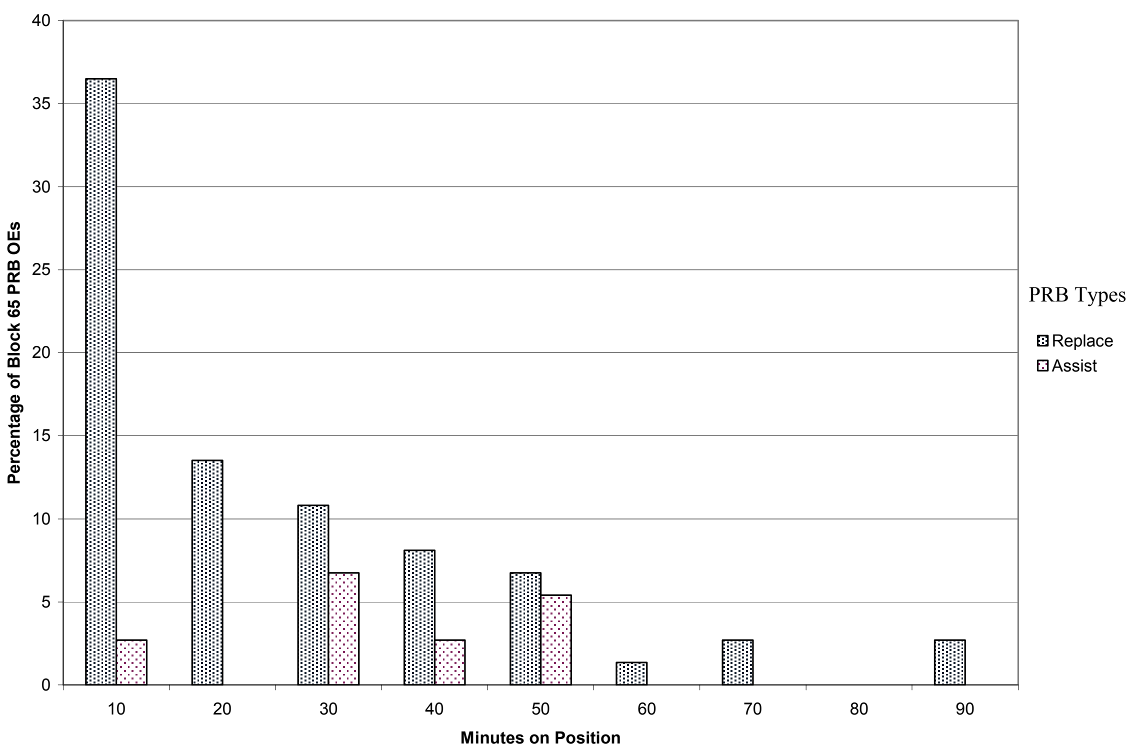

Figure 6. Percentage of Replacement and Assistance PRB OEs Included in Block 65 Summary of Incident.

Table 7. Frequencies and Percentages of Replacement and Assistance PRB OEs

	Briefings for Replacement			Briefings for Assistance		
TOP	R	CP	CS	SP	SS	Total
10	26 (35.1%)	1 (1.4%)	0 (0.0%)	2 (2.7%)	0 (0.0%)	29 (39.2%)
20	8 (10.8%)	1 (1.4%)	1 (1.4%)	0 (0.0%)	0 (0.0%)	10 (13.5%)
30	6 (8.1%)	0 (0.0%)	2 (2.7%)	1 (1.4%)	4 (0.0%)	13 (17.6%)
40	5 (6.8%)	0 (0.0%)	1 (1.4%)	2 (2.7%)	0 (0.0%)	8 (10.8%)
50	4 (5.4%)	0 (0.0%)	1 (1.4%)	3 (4.1%)	1 (1.4%)	9 (12.2%)
60	1 (1.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.4%)
70	2 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.7%)
80	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90	2 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.7%)
Total	54 (73.0%)	2 (2.7%)	5 (6.8%)	8 (10.8%)	5 (6.8%)	74 (100%)

* All percentages are based on a total of 74 Block 65 PRB summaries of incident narratives.

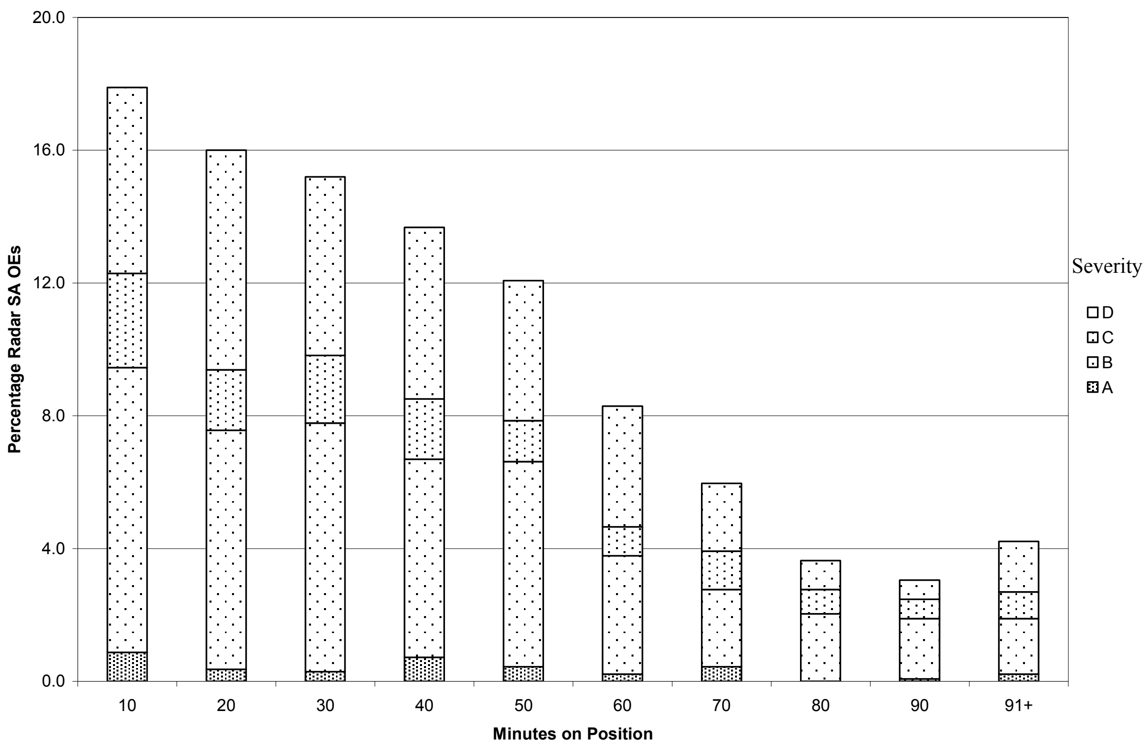

Figure 7a. Percentage of Radar SA OEs by Time on Position and Severity

control) and problematic position transfers, we restricted our examination of the merged data to include only PRB OEs that were substantiated through both the inclusion of Block 68 PRB items and the subsequent SME analyses of the summary of incident narratives. This restriction resulted in a relatively small subset of 24 OEs that are shown in Figure 9 and Table 10.

Using the 24 substantiated Radar SA-PRB OEs, we created an example of a more human factors-focused way of describing PRB OEs. The details are shown in Table 11. The table includes the case numbers (i.e., OE report numbers), OE SI classification, the time on position of the primary controller at the time of the OE, the kind of transfer, the problem identified with the position relief briefing, and why or how the briefing problem occurred. As an example, for Case 1, a Category B OE occurred 11 minutes after one radar controller replaced another radar controller. The incoming controller failed to use the information presented in the briefing to project the future status of the aircraft involved in the OE. Similarly, for Case 3, 31 minutes after the primary controller assumed position responsibility, a Category B OE occurred as the result of two sectors being combined. The outgoing controller failed to detect that he had not transferred radar identification for an aircraft (derived from the summary

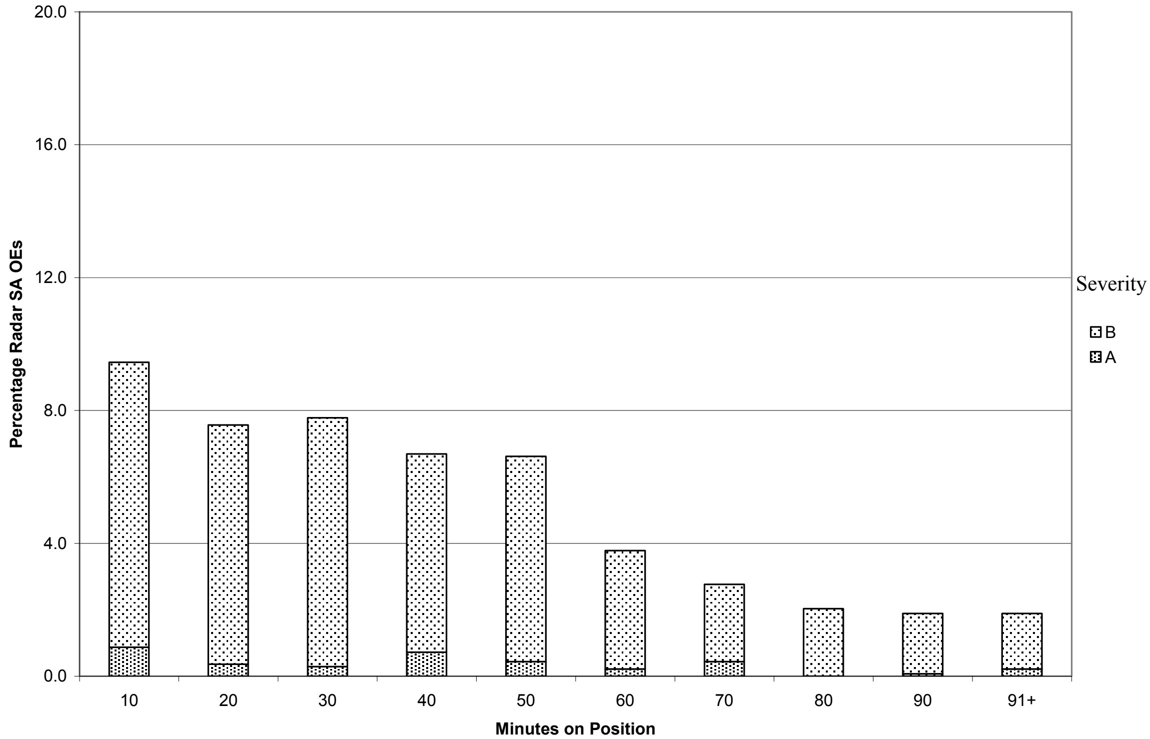

Figure 7b. Percentage of Categories A&B Radar SA OEs by Time on Position and Severity

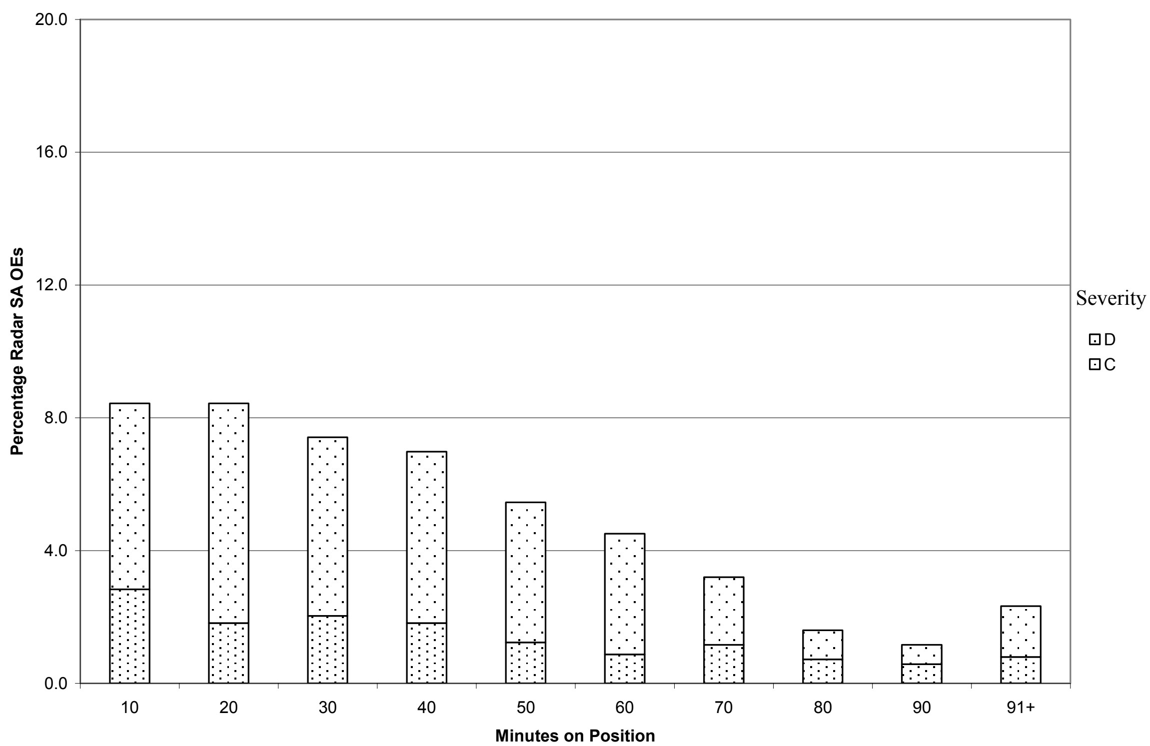

Figure 7c. Percentage of Categories C&D Radar SA OEs by Time on Position and Severity

of incident) that resulted in providing an incomplete position relief briefing. As can be seen in these two examples, presenting information in a format such as Table 11 not only aids in understanding the human factors associated with PRB OEs, it also provides a template for completing the incident summary OE report.

DISCUSSION

We began this study with the goal of conducting a critical analysis of the human factors associated with OEs that occurred because of something that went wrong during the position relief process/transfer of position responsibility. Our objective was to develop insight into how the position relief process might be improved to reduce OEs that occur within the first ten minutes following a

Table 8. Number and Percentage of Radar Situation Awareness OEs across Time on Position and OE Severity Index

Minutes on Position	Category A n	Category A %	Category B n	Category B %	Category C n	Category C %	Category D n	Category D %	Total n	Total %
10	12	0.9	118	8.6	39	2.8	77	5.6	246	17.9
20	5	0.4	99	7.2	25	1.8	91	6.6	220	16.0
30	4	0.3	103	7.5	28	2.0	74	5.4	209	15.2
40	10	0.7	82	6.0	25	1.8	71	5.2	188	13.7
50	6	0.4	85	6.2	17	1.2	58	4.2	166	12.1
60	3	0.2	49	3.6	12	0.9	50	3.6	114	8.3
70	6	0.4	32	2.3	16	1.2	28	2.0	82	6.0
80	0	0.0	28	2.0	10	0.7	12	0.9	50	3.6
90	1	0.1	25	1.8	8	0.6	8	0.6	42	3.1
91+	3	0.2	23	1.7	11	0.8	21	1.5	58	4.2
Total	50	3.6	644	46.8	191	13.9	490	35.6	1375	100

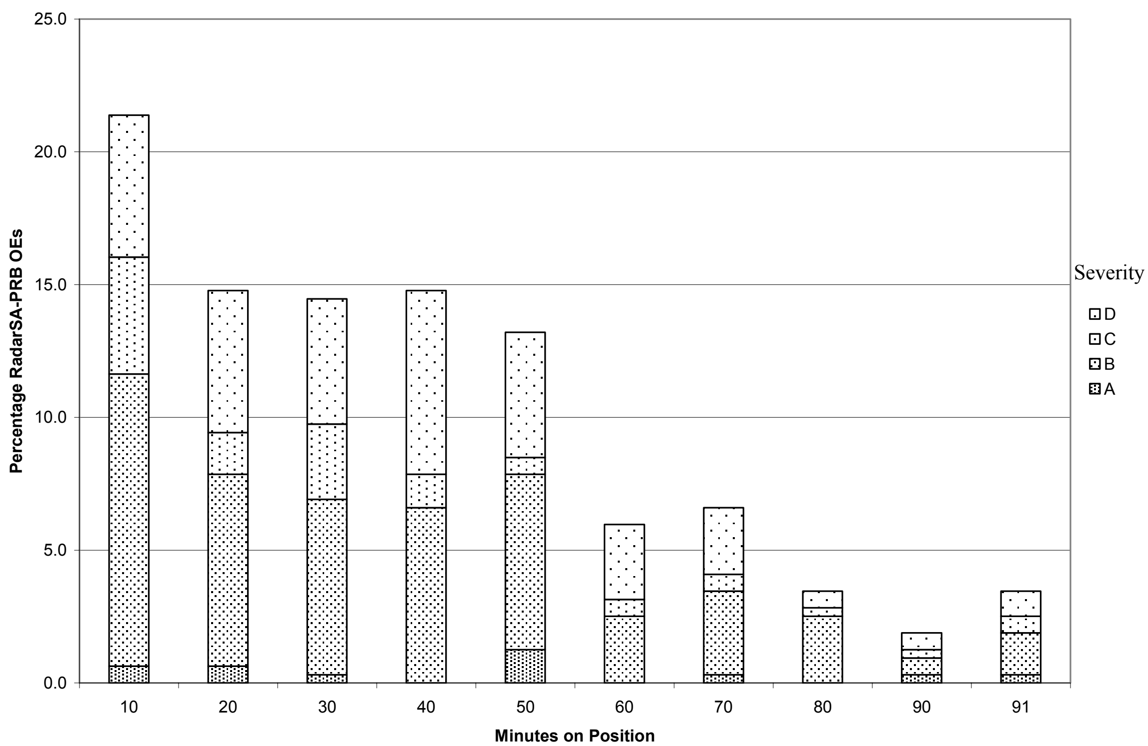

Figure 8. Percentage of Radar SA – PRB OEs (n = 78) by Time on Position and Severity

Table 9. Number and Percentage of Radar Situation Awareness – PRB OEs across Time on Position and OE Severity Index

Minutes on Position	Category A		Category B		Category C		Category D		Total	
	n	%	n	%	n	%	n	%	n	%
10	2	0.6	35	11.0	14	4.4	17	5.3	68	21.4
20	2	0.6	23	7.2	5	1.6	17	5.3	47	14.8
30	1	0.3	21	6.6	9	2.8	15	4.7	46	14.5
40	0	0.0	21	6.6	4	1.3	22	6.9	47	14.8
50	4	1.3	21	6.6	2	0.6	15	4.7	42	13.2
60	0	0.0	8	2.5	2	0.6	9	2.8	19	6.0
70	1	0.3	10	3.1	2	0.6	8	2.5	21	6.6
80	0	0.0	8	2.5	1	0.3	2	0.6	11	3.5
90	1	0.3	2	0.6	1	0.3	2	0.6	6	1.9
91+	1	0.3	5	1.6	2	0.6	3	0.9	11	3.5
Total	12	3.8	154	48.4	42	13.2	110	34.6	318	100.0

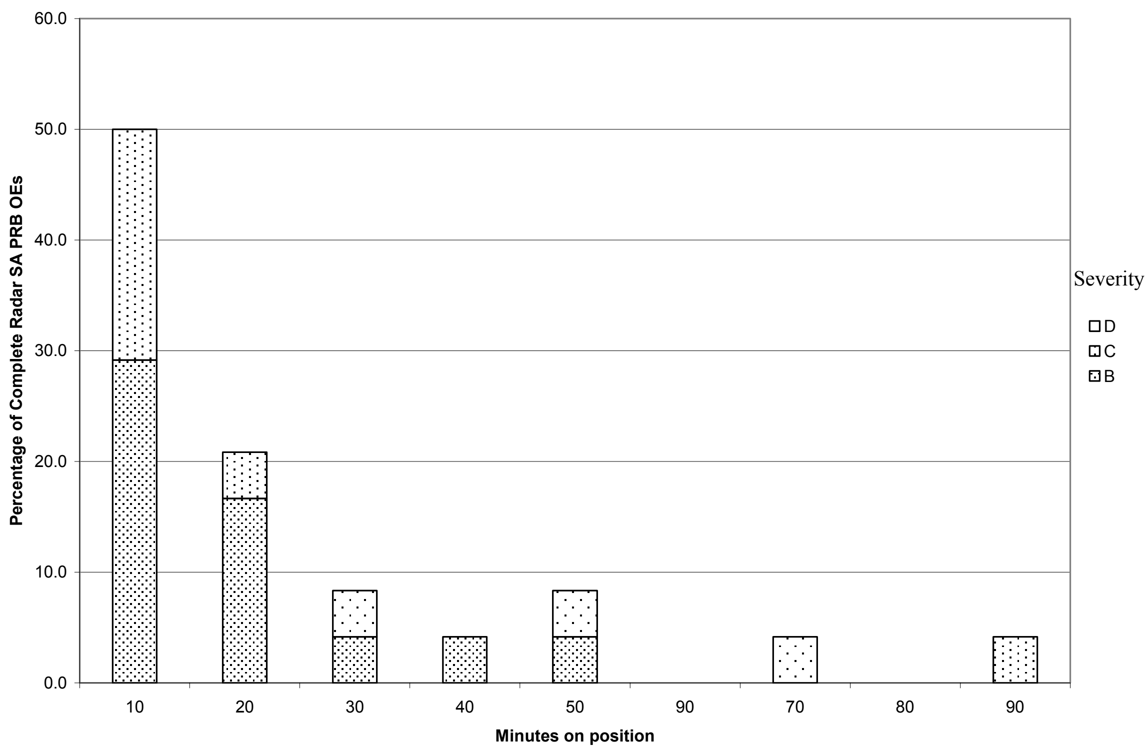

Figure 9. Percentage of Substantiated Radar SA –PRB OEs by Time on Position and Severity

Table 10. Number and Percentage of Substantiated Radar Situation Awareness – PRB OEs Across Time on Position and OE Severity Index

Minutes on Position	Category B n	Category B %	Category C n	Category C %	Category D n	Category D %	Total n	Total %
10	7	29.2	5	20.8	0	0.0	12	50.0
20	4	16.7	1	4.2	0	0.0	5	20.8
30	1	4.2	0	0.0	1	4.2	2	8.3
40	1	4.2	0	0.0	0	0.0	1	4.2
50	1	4.2	0	0.0	1	4.2	2	8.3
60	0	0.0	0	0.0	0	0.0	0	0.0
70	0	0.0	0	0.0	1	4.2	1	4.2
80	0	0.0	0	0.0	0	0.0	0	0.0
90	0	0.0	1	4.2	0	0.0	1	4.2
Total	14	58.3	7	29.2	3	12.5	24	100.0

position transfer. Although we found that the current OE reporting form contained some useful information, we were disappointed that much of the information that we expected to find was absent in the OE database. For example, most of the designated PRB OEs lacked supporting information in the database. Despite the lack of data, we were able to advance the human factors understanding of the position relief process.

Findings

We have learned that there are two kinds of position transfers: those associated with replacement and those associated with providing assistance. The most common form of replacement transfer is to provide a break for the relieved controller. Transfers of replacement can occur under varying traffic levels (i.e., traffic loads); however, they more commonly occurred when the traffic load was sufficiently low so as not to create a safety hazard. Although controllers can rush the transfer of control during replacement, there generally is no external time pressure to do so (at least none were mentioned in the narratives for PRB-related OEs). Time pressures were evident, however, when a transfer occurred to provide workload assistance. The most common form of providing assistance was through the splitting of positions and sectors. During these types of transfers, the PRB OE summaries indicated the need to quickly accomplish the transfer because the workload was rapidly exceeding the safety capacity of the controller on position. Typically, problems with this kind of transfer resulted from: (a) a delayed request by the active controller to split the sector or position, or (b) a delayed action of the supervisor/controller in charge to accommodate an active controllers request or (c) a delayed action of the supervisor/controller in charge to initiate a position or sector split, even though the controller did not ask for it.

Although the OE sample sizes were small for both transfers of replacement and assistance, due to a lack of information in the OE database, the results suggest that the position relief briefing process should address the unique human factors circumstances/vulnerabilities surrounding both types of position transfers, especially when the transfer process is rushed. It is one thing to emphasize that position transfers should not be rushed. However, if, for whatever reason, there is only a short window of opportunity for the position transfer to occur, then the controllers involved have to depart from the ideal and address the reality that they face. Do the human factors vulnerabilities differ between a rushed replacement transfer, as compared to a rushed assistance transfer? For example, do controllers operate from a different mindset when they are being replaced vs. when they are offloading only a portion of their position? Questions such as these suggest that, although we have prescribed procedures that govern the position relief process, we know little about the varying states of mind and corresponding mental processes that are activated during a position transfer.

One solution to this problem is to provide a human factors OE investigation diagnostic tree as an aid to OE investigators (Pounds & Isaac, 2002; and Pounds & Isaac 2003). To illustrate this point, consider the transfer of position information listed in Table 11. For Case 1, the OE data suggest that the relieving controller did not use the briefed information and, thus, failed to project the future status of an aircraft, which then resulted in a loss of separation. However, insufficient information was available to allow the analyst to determine whether the controller forgot to use the information briefed or did not bother to spend time thinking about the ramifications of

Table 11. Complete Analysis of OEs Related to the Position Relief Process

Case	OE Severity	Minutes On Position	Transfer Involved*	Reason For Transfer**	Did Not Use Checklist	Gave Incomplete Briefing	Did Not Use Briefed Information	Briefing Other	Did Not Detect	Did Not Comprehend	Did Not Project
1	B	11	RR	R	N	N	Y	N	N	N	Y
2	C	2	UNK	UNK	N	N	Y	N	N	N	Y
3	B	31	RR	CS	N	Y	N	N	Y	N	N
4	B	8	RR	R	N	Y	N	N	N	Y	N
5	D	49	RR	CS	N	N	Y	N	Y	Y	Y
6	C	3	RR	R	N	N	Y	N	N	N	Y
7	C	13	UNK	UNK	Y	N	N	N	N	N	Y
8	B	20	UNK	UNK	N	Y	N	N	N	Y	Y
9	B	9	UNK	UNK	Y	N	N	N	N	Y	N
10	B	0	RR	R	N	Y	N	N	N	N	Y
11	B	1	UNK	UNK	N	N	Y	N	N	N	Y
12	B	1	UNK	UNK	N	N	Y	N	N	Y	Y
13	D	65	RR	R	N	N	Y	N	Y	Y	Y
14	C	88	RR	R	N	Y	N	N	Y	Y	Y
15	C	4	RR	R	N	N	Y	N	N	N	Y
16	B	13	RR	R	N	Y	N	N	Y	Y	Y
17	D	27	UNK	UNK	Y	N	N	N	Y	N	N
18	B	18	UNK	UNK	N	N	Y	N	N	Y	N
19	B	44	RR	R	N	Y	N	N	Y	N	N
20	C	5	UNK	UNK	N	N	Y	N	Y	Y	Y
21	B	23	RR	R	N	Y	N	N	Y	Y	Y
22	B	4	RD	SP	Y	N	N	N	Y	Y	Y
23	C	8	RR	R	N	N	Y	N	Y	Y	Y
24	B	4	UNK	UNK	N	N	N	Y	Y	Y	Y
Total	24	24	14	14	4	8	11	1	12	14	18

*RR = R-side to R-side, RD = R-side to D-side, UNK = Unknown, **R = Replacement, CS = Combined Sectors, SP = Split Position, UNK = Unknown

the information received. The human factors diagnostic tree used should provide sufficient detail to ensure that the investigator can make a distinction between these two lines of reasoning. The distinction becomes especially important when trying to develop human factors interventions to reduce a particular type of OE. Efforts to improve memory are not likely to show an effect on OEs related to "not taking enough time to think about the ramifications of the information being received."

The above line of reasoning forces us to face a crossroads in OE reduction efforts. Past OE reduction efforts, as reported in Schroeder et al. (2006), looked for systemic problems that would allow for a generalized approach to reducing OEs. This is a statistical approach in which individual differences are ignored and system-wide interventions are implemented. However, for the individual involved in a given OE, the cause is not a statistical trend. Instead, the cause of the OE is associated with the specific mental processes (e.g., perception and vigilance, memory, and planning and decision making) and contextual conditions (e.g., static and dynamic sector characteristics) that affect the controller's performance. Thus, if we are to address the training needs of a given individual, we will have to switch from implementing a generalized training plan to a training plan that is customized to address specific needs based on the specific circumstances encountered.

For example, an incoming controller who does not spend sufficient time mentally preparing to assume position control may not be aware of it. It is one thing to talk or read about the need to spend sufficient time preparing oneself to assume position control, but it is something altogether different to experience the need to do so. For the latter, the training experience must provide sufficient performance feedback to validate that the lack of mental preparedness adversely affected the safety margin associated with controlling traffic. The same training environment should also demonstrate that adherence to the training regimen produces a corresponding improvement in the margin of safety. Typically, these types of training experiences are obtained within a simulated work environment such as used by the airlines in their line-oriented flight training, LOFT (FAA, 2004).

There is more to identifying training needs, however, than using information derived from OEs. As previously mentioned, we do not know much about controller mistakes that occur during normal operations. It is possible that there is nothing different about controller mistakes associated with OEs, compared to controller errors that occur during normal operations. If this proves to be the case, then identifying training needs has to extend beyond efforts to reduce OEs to include an overall reduction of controller mistakes. Although various field studies and facility safety audits have collected information about the kinds of controller errors that occur during normal operations, the quality and quantity of the information collected varies and makes it difficult to draw definitive conclusions. One way of addressing this problem is to conduct standardized system-wide safety audits during normal operations for all air traffic control facilities. While at first glance this may seem like a formidable task, similar types of safety audits have been implemented in the airlines by using the Line Operations Safety Audit (LOSA) concepts detailed in the FAA Advisory Circular 120-90 (FAA, 2006b) and the Normal Operations Safety Survey used by the International Civil Aviation Organization to transfer LOSA concepts to air traffic control (ICAO, 2005).

However, even if improvements are made in the way we identify and address OE causes, we still will not be able to quantify the success of our efforts unless we have a reliable and valid monitoring system. Reliability refers to the intra- and inter- facility consistency with which OE investigators and/or facility managers complete the initial and final OE investigation forms. Validity refers to whether the data collected are truly representative of what occurred during the OE. When issues of reliability and validity are ignored, the resulting monitoring system will not be able to distinguish between successful OE reduction efforts and those that have failed. As we stated earlier, much of the information that should have been included in the OE report about PRB OEs was missing. Given that data were evidently missing across all en route centers, we wondered what processes could be operating that appeared to be undermining the reporting of OEs.

In discussing the above problem with our SMEs and with those ATO representatives who were present during our project briefings, we identified three possible mechanisms. First, past organizational practices associated with the documentation of OE causal factors may be at odds with the current need to determine the success or failure of specific OE reduction efforts. For example, it was reported to us that during the course of an OE investigation, it is not uncommon for investigators/ facility managers to report any departure from facility standards (e.g., not using PRB checklist), even if the departure was unrelated to the OE (e.g., OE was due to a hearback error). Using the OE reporting process in this way prevents us from being able to differentiate between causes of OEs and failures to follow facility procedures. Both are important to identify; however, whereas the former relates directly to the cause of the OE, the latter is related to the broader safety culture and speaks to the controller's failure to abide by national and/or facility standards.

Another example of a problematic organizational practice that was described by our SMEs relates to the failure of investigators/facility managers to differentiate between the major and minor headings of Block 68 of Form 7210-3 (see appendix B). Each of the major headings represents one of the six OE causal factors listed in Table 2. Beneath each major heading there are numerous minor headings that provide greater specificity about a given OE cause. As the directions in Appendix B reveal, each time a major heading is marked, the investigator is expected to also mark all the minor headings that apply. When the hierarchical structure of Block 68 is ignored and all headings are treated as being on the same level, then it is possible for an OE investigator to indicate that one or more of the six causal factors were associated with the OE (e.g., the position relief briefing), without providing any specific information. Of course the problem is compounded when one considers that not all OE investigators follow the same procedures. As can be seen by both examples, without knowledge of the organizational practices associated with the OE reporting process, the interpretation of human factors causal data extracted from the OE database remains suspect.

A second mechanism that may undermine the reliability and validity of the OE reporting process has to do with the benefit (or the lack thereof) that the facility receives from entering data into the OE database. If, as we were told, facility management perceive that they receive little or no benefit from the OE database, what motivation is there to invest the time and resources to ensure the reliability and validity of the data entered? In the absence of any benefit, facility management is more likely to create its own system for addressing OEs, and simply enter data into the OE database as an administrative task, without taking particular concern to ensure its reliability and validity.

The third and final mechanism that undermines the reliability and validity of OE reporting is labor management relations. The current OE reporting process attempts to identify what went wrong and, if the controller is found to be at fault, to determine the appropriate course of action before the controller can return to duty. Although, from a legal accountability perspective (i.e., punish the one at fault) this may make sense, it is difficult to imagine that a controller would be willing to reveal his/her actual decision process in effect at the time of the OE if greater disclosure would lead to greater punishment. One has to wonder how a culture of punishment affects the quality of information preserved in the OE database. In fact, this is precisely the question that James Reason (1997) addressed in his formulation of a "*Just Safety Culture*."

Reason argued that a just safety culture was one in which an atmosphere of trust exists in which people are encouraged (even rewarded) for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable blameless and blameworthy actions. The distinction between blameless and blameworthy actions is especially important, given that, as Reason reports, most people do not purposely try to make mistakes. Rather than punishing good intentions, Reason argues that the mistakes themselves should serve as learning opportunities for both the individual and the organization. Instead of fearing punishment, individuals who made honest mistakes should feel free to bring them to the attention of their supervisors and others. In this way, organizations can discovery why mistakes occur and whether the mistakes of individuals reflect a systemic problem(s) embedded within existing organizational policies, procedures, and practices.

The above problems, however, are not unique to the FAA. In fact, the need to improve human error reporting and management are some of the driving forces behind the current emphasis on developing safety management systems (SMSs; FAA, 2006c). SMS is essentially an approach to controlling risk. SMS emerged from the conclusion that there will always be some degree of risk in interrelated systems. Rather than attempting to completely eliminate risk through extensive inspection and remedial actions, SMS emphasizes reducing the severity and/or the likelihood of risk associated with system-wide safety hazards. These goals are accomplished by identifying the hazards, assessing the risk, analyzing the risk, and controlling the risk. The latter of which is accomplished through a feedback system that ascertains the effectiveness of mitigation strategies designed to reduce safety risks.

Although the FAA has participated in a number of national and international efforts designed to promote SMS in aviation, there is not currently an SMS in place for managing the human errors associated with controlling traffic. This may become especially problematic since, as Dobbs (2007) reports, up to 60% (12,500) of the controller workforce (approximately 20,000 including supervisors) is projected to retire over the next decade, resulting in a hiring surge of new controllers. With that surge there comes the risk of a corresponding increase in the amount of human error commonly attributed to inexperience. Given that implementing a fully integrated SMS takes time, now is a good time to begin the process.

Future Directions

We conclude this report with a final thought on reducing OEs that occur during the first ten minutes on position. At the time of this report, we, like Lowry (2005), were unable to obtain controller time of position information about normal operations. It is possible that the reason so many OEs occurred during the first ten minutes is that there are more position transfers happening during the first ten minutes, compared to any other ten-minute time interval. If this proves to be true, then one solution to reducing OEs would be to eliminate unnecessary position transfers when the outgoing controller has been on position ten minutes or less. However, without more definitive information about normal operations, this suggestion remains just a suggestion, albeit one that could be empirically tested.

CONCLUSIONS

The high percentages of OEs occurring early on position are likely to be the result of a breakdown in the cognitive processes associated with controlling traffic. The current OE investigation process is insufficient for determining what the controller was thinking at the time of a position transfer. This lack of information undermines the effectiveness of interventions designed to reduce OEs that occur early on position. Controlling traffic is predominately a cognitive task and, thus, the identification of OE causes should better reflect the mental processes affecting controller actions. Controllers need to be especially vigilant about these processes during position transfers. The failure of past interventions designed to reduce OEs that occur early on position may not be due to ineffective interventions but, instead, may be due to ineffective measurement techniques.

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APPENDIX A

INSTRUCTIONS FOR FAA FORM 7210-2, PRELIMINARY OPERATIONAL ERROR/DEVIATION INVESTIGATION REPORT

REPORT NUMBER:
FAC ID: Enter the facility three-character identifier.
TYPE: Enter the type of facility ("**T**" – Terminal, "**R**" – TRACON, "**C**" - En Route, and “**F**" - Flight Service)
NOTE - Use "R" for stand alone radar facilities assigned a separate facility three-character identifie.
CY: Enter the last two digits of the calendar year in which the incident occurred.
E/D: Enter "**E**" for an error or "**D**" for a deviation.
SEQ.#: Enter the sequential number of the incident for the calendar year.
*Note - Each calendar year operational errors will start with 001 and operational deviations will start with 001 (however, they are counted separately). **e.g., ZDC-C-01-E-005**.*
Block 1 Date and Time of Occurrence: Date is based on local time, enter time in Local and time in UTC.
Block 2 Date and Time Initial Investigation Started: Date is based on local time; enter time in Local and in UTC.
Block 3 Facility: Check “FACILITY” if your facility personnel initially reported this incident or check “OTHER” if equipment (i.e. OEDP, CA), another facility, pilot or organization reported this incident.
Block 4 Involved Facilities: List all other facilities that may have contributed to this incident.
Block 5 Altitude: Enter "SFC" if this is a surface incident; otherwise enter altitude at which loss of separation occurred.
Block 6 Location: Use a VOR Fix/Radial/Distance that is compatible with the appropriate altitude stratum. For surface events, use runway numbers, taxiway names, or other locations found on airport diagrams. For Oceanic events use Latitude & Longitude.
Block 7 Closest Proximity: Do not leave blank. Indicate Feet, Miles or Minutes. This IS the closest proximity, not just the first hit under the required loss of separation or OEDP. If estimated, indicate method in Summary, Block 21. Where no other aircraft were involved, as in closed-runways or MVA incidents, indicate and explain in Summary, Block 21.
Block 8 Alerts: Check "ACTIVATED" if an alert was generated during the incident.
Check "NOT ACTIVATED" if this feature is installed and functioning, but did not generate an alert during the incident.
Check "NOT AVAILABLE" if this feature is installed, but was not available during the incident.
Check “SUPPRESSED” only if this feature was suppressed.
Check "NOT INSTALLED" only if the facility does not have this feature.
Block 9 TMU: Complete each item that applies to your facility, otherwise leave blank.
Item a. Enter Monitor Alert Parameter (MAP) or other automated alert function, for the sector/position(s) involved. **Item b.** Check “ACTIVATED” if an alert was generated during/or before the incident.
Check “ NON-ACTIVATED” if this feature is installed and functioning but did not generate an alert.
Check “NOT AVAILABLE” if this feature is installed at the facility, but was not available during the incident.
Item c. Were any initiatives in place in response to sector/position volume or complexity, check Yes or No and explain why if volume or complexity may have contributed to this incident?

Blocks 10:
Item a. Traffic Volume: Enter the number of aircraft for which the controller had separation responsibility, including point outs. For incidents involving tower cab local controllers, do not count aircraft waiting in line for departure unless the controller was, for some reason, responsible for separation.
Item b. Traffic Complexity: Circle traffic complexity with “Low” being number 1, “Moderate” as number 3 and “High” as number 5.
Block 11 Type of Control: Check “RADAR” if the incident occurred within a radar environment.
Check “NON-RADAR” if incident occurred within a non-radar environment.
Check “OCEANIC” if the incident occurred within an oceanic environment.
Check "TOWER" if incident occurred within a tower environment (also check "RADAR," if the cab controller had radar available).
Check “AFSS/FSS” if the incident occurred within a flight service environment.
Block 12 Required Separation: Check "FAA DIRECTIVE" if the required separation was from a FAA directive such as FAA Order 7110.65, or a facility directive. List specific paragraph that was violated/misapplied.
Check "LETTER OF AGREEMENT" if the required separation was from a letter of agreement with another facility or organization, (e.g., An LOA requiring 8 miles separation between aircraft in specified areas). List specific paragraph that was violated/misapplied.
Block 13 Controller Information: Item a. Enter last six digits of the employees Social Security Number **(DO NOT ASK THE EMPLOYEE)**, e.g., 55-1234
Item b. Enter Title/certification status, e.g., "CPC/OS/CIC/OM/DEV/TMC/TMS/ATM/SS”.
Item c. Enter time on position, e.g., 75 **(in minutes)**.
Item d. Enter Area and Sector or Position Designation, e.g., "Area A-R71/D71" or "South Satellite."
Enter **ALL SECTORS/POSITIONS** that were combined to the position at the time of the incident.
Item e. Enter date of last certification, and include Initial or Recertification, e.g., I 1+07 (year+months)
Item f. Enter all previous Errors and/or Deviations within the last 2-½ years, including dates. Explain factors identified in previous errors in Summary, Block 21.
Block 14 Hand Off Position: Item a. Was a RA/D-side/Tracker/HO or Coordinator assigned to this radar position? If no and volume or complexity may have been a factor, explain in Summary, Block 21.
Item b. Was a Local or Ground Associate assigned to the Tower position? If no and volume or complexity may have been a factor, explain in Summary, Block 21.
Block 15 Staffing: List Staffing levels at time of incident. **Note:** this applies to staffing in the specific function/area that this incident occurred in, e.g., combined TRACON/Towers, incident occurred in TRACON, list only the staffing for employees assigned to the TRACON at the time of the incident. Only list CIC’s if that individual has been assigned CIC duties for the shift.
Block 16 Position Profiles: List position/sector(s) available in the area, radar room, sector or tower cab, WHERE the incident occurred.
Block 17 Operational Supervision: Item a. Identify if an OS or a CIC was in charge, when the incident occurred.
Item b. Describe the OSIC/CIC actual activity when the incident occurred. Be Specific, e.g., on the phone, coordinating with TMU about the no notice hold into EWR.

Block 18 Weather Sequence: Provide the most applicable weather sequence (nearest in location and time to the OE/D), identifying the source and time. List all PIREPS/SIGMETS /AIRMETS valid for the area.

Block 19 Aircraft Information: Items a – c Enter the involved Aircraft's callsign, type aircraft, and equipment suffix. Check "NRP" if the aircraft was on a filed National Route Program flight plan (not just issued "direct"). Check "TCAS RA" if the aircraft advised it had received a Resolution Advisory. Check "NMAC" if the pilot stated he encountered or intended on filing a NMAC Report. Enter route of flight, pertinent to this incident.

Block 20 Terminals Only: Runway Incursion information; answer all questions if applicable.

Block 21 Possible Factors: This is a short list of possible factors that may have been involved in the incident. The person filling out this form should use this block as a general checklist to help develop the description of events in the summary. Enter all additional factors preliminarily determine to be contributory to the incident e.g., controller judgment, visual observation, distractions. Ensure that the rationale for each possible factor identified is clearly described in Summary, Block 21.

Block 22 Summary: The description of events should be factual and concise, but must include all pertinent information. Ensure that the rationale for each possible factor identified in Block 20 is clearly described. Use terms such as "Aircraft #1" and "Controller A" rather than actual call signs and position identifiers or names. Additionally, explain employee's activities at the time of the event as outlined in Block 13 and (if applicable) why no HO/D-side/Tracker/Local/Ground associate was assigned, as outlined in Block 14.

Block 23 Data Reviewed: Indicate if the voice tape, computer data, employee statements or radar replay were reviewed prior to filing this report.

Block 24 Notification: Item a. This is the person from the facility reporting the incident to Regional and Headquarters personnel.

Item b. This is the individual from the Regional Operations Center (ROC), Regional Quality Assurance Specialist (AXX-505), Washington Operations Center (WOC), and Headquarters Safety Investigator (AAT-200) receiving the report.

Severity Classification (Preliminary & Final)	**Report Number**
(Notify AAT-200, WOC & ATD thru the ROC within 3 hours)	FAC ID - TYPE - CY - B/D - SEQ #

1. DATE AND TIME OF OCCURRENCE:

DATE (LOCAL) | Time (local) | Time (utc)

2. DATE AND TIME INITIAL INVESTIGATION STARTED:

DATE (LOCAL) | Time (local) | Time (utc)

3. INITIALLY REPORTED BY:

☐ FACILITY ☐ OTHER (Explain here)

4. OTHER INVOLVED FACILITIES:

FAC ID #1 | FAC ID #2

5. Altitude:

Indicate if on the Surface

6. Location of Occurrence:

Pertinent fix (Fix/Radial/DME), airport surface location or Lat/Long.

7. CLOSEST PROXIMITY:

Vertical | Lateral (ft/mi/min)

8. ALERTS: (If installed, explain checked boxes in Summary, Block 21)

CONFLICT ALERT:	Activated ☐	Not activated ☐	Not available ☐	Suppressed ☐	Not installed ☐
MSAW / EMSAW:	Activated ☐	Not activated ☐	Not available ☐	Suppressed ☐	Not installed ☐

9 TMU: a. M.A.P. **b. Alerts:** ☐ Activated ☐ Non-activated ☐ Not available

c. Were any initiatives in place, in response to sector/position volume: ☐ Yes ☐ No

d. If either yes or no, **explain why here**:

10 a. Traffic Volume: (# of ACFT) **b. Traffic Complexity:** Low 1 2 3 4 5 High

11. TYPE OF CONTROL:

☐ RADAR
☐ NON-RADAR
☐ OCEANIC
☐ TOWER
☐ AFSS/FSS

12. REQUIRED SEPARATION:

☐ FAA DIRECTIVE

Required Separation | Handbook and Paragraph

☐ LETTER OF AGREEMENT, WITH:

FAC. or ORG. | Paragraph | Required Separation

13. CONTROLLER INFORMATION (Explain activities of each individual in Summary, Block 21):

	Primary	Contributory	Contributory	Contributory
a. Last 6-digits of SSN:				
b. Title (CPC/DEV/OS/CIC/OM//TMC/TMS/SS/ATM):				
c. Time on position (in minutes):				
d. Area/Sector/Position(s), List ***ALL*** positions combined:				
e. Date of last certification (Initial or Recertification):				
f. List previous Errors and/or Deviations:				

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14 a. ARTCC/TRACON: Was a RA/D-side/Tracker/HO/Coordinator position staffed? Yes No N/A
(If no and volume or complexity was a factor explain in Summary, Block 21)

14 b. Tower: Was Local or Ground Associate positions staffed? Yes No N/A
(If no and volume or complexity was a factor explain in Summary, Block 21)

15. STAFFING	On Duty	On Position	On Break	Other	**16. NUMBER OF POSITIONS IN AREA/SECTOR:**
a. OS/CIC					a. Available
b. CPC					b. Open
c. DEV					

17 a. OPERATIONAL SUPERVISION: OSIC CIC
b. What was the OSIC/CIC doing when the incident occurred? (Explain and ***Be specific***.)

18. WEATHER SEQUENCE:
VMC IMC DUSK DAWN

19. AIRCRAFT INFORMATION

a. Aircraft #1:	TYPE/SUFFIX	NRP	TCAS RA: What action was taken?	NMAC
Route of Flight/Taxi Route				
b. Aircraft #2:	TYPE/SUFFIX	NRP	TCAS RA: What action was taken?	NMAC
Route of Flight/Taxi Route				
c. Aircraft #3:	TYPE/SUFFIX	NRP	TCAS RA: What action was taken?	NMAC
Route of Flight/Taxi Route				

20 Terminal only:
a.Was takeoff clearance issued YES NO?
b.If yes, did aircraft start takeoff roll YES NO?
c.Was takeoff clearance cancelled YES NO?
1.Was aircraft able to abort YES NO?
2.Did aircraft hold in position: YES NO?
3.Proximity when departing aircraft was at taxi speed?
4.How far did aircraft roll in feet?
d.Was any clearance issued or amended YES NO? Explain:
e.Was either aircraft issued a go around YES NO?
1.If yes, what was mileage on final when instructions where issued.

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21. POSSIBLE FACTORS: (Check or indicate as many possible factors as you can identify and explain each factor below in Summary, Block 21) Procedures Equipment Communications (Hearback/Readback) Traffic Management Other(s)
22. SUMMARY: Please describe the events surrounding the incident that occurred. Consider the list of factors above and describe them as necessary to explain the incident. If you receive any Pilots' Comments, please explain what they where here, Be brief as possible, but still FULLY explain the incident:
23. DATA REVIEWED: VOICE TAPE COMPUTER DATA EMPLOYEE STATEMENTS EMPLOYEE INTERVIEWS REPLAY (SATORI, RAPTOR, Other)
24 a. PERSON MAKING NOTIFICATION: (Facility) DATE & TIME (LOCAL):
24 b. PERSON RECEIVING NOTIFICATION: AXX-505: DATE & TIME (LOCAL):

ROC TIME (LOCAL):	WOC TIME (LOCAL):	(AAT-200) DATE & TIME (LOCAL):

FAA FORM 7210-2

INSTRUCTIONS FOR FAA FORM 7210-3, FINAL OPERATIONAL ERROR/DEVIATION REPORT

GENERAL INFORMATION

The Final Operational Error/Deviation Report (OE/OD), FAA Form 7210-3, has been designed to facilitate the gathering and documentation of factual information concerning the events, which led to the occurrence of an operational error or deviation. It also provides a means of reporting the findings, recommendations, and conclusions of the facility manager and the regional ATD manager.

Situations may arise which are not adequately accounted for in Part I of this report. However, a careful analysis of the facts should usually establish a relationship to the information required in this report. If there are exceptions, when the information cannot be adequately expressed, or there is insufficient room to answer a question, use Block 64, Summary of Incident. Each comment should be prefaced with the block number to which it pertains.

An "*" indicates that an explanation is required or may be required in Block 65, Summary of Incident.

REPORT NUMBER

FAC ID - Enter the facility three-character identifier.

NOTE:
If the facility chargeable for the error/deviation is ARINC, enter "XXX" as the facility three-character identifier.

TYPE - Enter the type of facility:

"T" - Tower
"R" - TRACON

NOTE:
Use "R" for radar only facilities assigned a separate three-character identifier.

"C"- En Route
"F" - Flight Service

NOTE:
ZSU and ZHN should be entered as TRACON facilities and ZUA should be entered as an en route facility.

CY - Enter the last two digits of the calendar year in which the incident occurred.

E/D - Enter "E" for error or "D" for deviation.

SEQ# - Enter the sequential number of the incident for the calendar year. Each calendar year operational errors will start with 001 and operational deviations will start with 001. For example, the facility's' second operational error is 002 and the thirteenth would be 013. The facility's second operational deviation will be 002 and the thirteenth would be 013.

PART I – INVESTIGATIVE DATA

GENERAL INFORMATION

Part I provides for the documentation of the factual data which is gathered by the Investigator-In-Charge (IIC) and, when appointed, an investigation team.

Block 1 - DATE AND TIME OF INCIDENT

The time of an OE is the time that the loss of separation occurred. The time of an OD is the time that the airspace was violated.

DATE: Use the date based on the local date:

EXAMPLE: May 4, 1996 would be entered as "05/04/1996."

TIME: Using the 24-hour clock, enter the local time of the incident.

EXAMPLE*- 3:38 p.m. (Time of incident) would be entered as "1538."*

Block 2 - RESPONSIBLE FACILITY AND CLASSIFICATION LEVEL

Responsible Facility: The three-letter identifier of the facility completing the report will be automatically entered in this block after the report number has been entered.

Classification Level: Enter the classification at the time of the incident of the facility completing the report. Valid entries are 1 through 5. This will be automatically printed for each incident after the initial facility information is entered in the automated program.

Block 3 – SEVERITY INDEX

Indicate whether this error was classified as: a Low, Moderate, or High severity, Controlled with no TCAS, Controlled with TCAS RA or Uncontrolled and Converging, Opposite Courses, Converging, Crossing Courses, Same Course or Diverging/Non-intersecting Courses as determined by AAT-20

*** Block 4 - WAS WEATHER A FACTOR IN THE INCIDENT?**

If weather or conditions caused by weather were pertinent to the incident, select "Yes" and explain fully in Block 65, Summary of Incident.

For example, if thunderstorms caused an unexpected route

deviation or icing affected the climb, of an aircraft that was involved in an OE/OD, at the time of the incident, select "Yes" and explain.

Block 5 - ALTITUDE/FLIGHT LEVEL OF INCIDENT

IF INCIDENT HAPPENED	ENTER
On the surface	SFC
In the air	Enter an altitude above the surface to the nearest 100 feet omitting the last two digits. ***Example**s:* 1 foot - 149 feet, enter "001" 750 feet, enter "008" 1150 feet, enter "012" 29,700 feet, enter "297"

Block 6 - TYPE OF AIRSPACE

Select the type of airspace where the incident occurred, "Other" will require additional information.

Block 7 - LOCATION OF INCIDENT

If the incident occurred in the air, complete FIX, DIRECTION, and DISTANCE unless the location is best described by latitude and longitude.

If the incident occurred on the surface, complete INTERSECTION, RUNWAY and TAXIWAY.

If the incident occurred in the air and is best described by latitude and longitude or in oceanic airspace, complete LATITUDE and LONGITUDE.

FIX: The fix provides a reference as to where the incident occurred. Enter a 3- or 5-letter location identifier whenever possible to clearly identify the fix.

***EXAMPLE**- Dryer VORTAC would be entered as "DJB." NESTO intersection would be entered as "NESTO."*

DIRECTION: Use three digits to indicate the degrees of the radial or course from the NAVAID. If the fix used is an airport, intersection, or waypoint that does not have prescribed radials or a compass rose, use the 16 points of the compass to describe direction.

***EXAMPLE**- The 10 degree radial would be entered as "010." North-Northeast would be entered as "NNE."*

DISTANCE- Specify the distance of the incident from the fix in nautical miles.

***EXAMPLE**- One nautical mile would be entered as "001." Twenty nautical miles would be entered as "020."*

INTERSECTION- Enter the airport intersection closest to the incident.

RUNWAY- Enter the runway(s) closest to the incident. Use a "/" to separate runways that are not left, right, or center. Do not exceed 6 digits.

***EXAMPLE**- Runway 9 would be entered as "000009." If the incident occurred at or near the intersection of runway 3 and runway 12, it should be entered as "003/12." Runways 9L and 17R would be entered as "09L17R."*

TAXIWAY- If the taxiway is described using the phonetic alphabet; enter the letter not the word.

***EXAMPLE**- Echo would be "E" and HOTEL 1 would be "H1."*

LATITUDE:

***EXAMPLE**- For 48 degrees 35 minutes NORTH, enter "N 48 30 0."*

LONGITUDE:

***EXAMPLE**- For 153 degrees WEST, enter "W 153 0 0."*

Block 8 - CLOSEST PROXIMITY

Complete this block for incidents in the air and on the surface.

For aircraft in flight, the closest proximity is expressed in lateral/longitudinal and vertical measurements. When separation is lost, determine the closest proximity as follows: Enter the smallest lateral/longitudinal distance that existed between the aircraft while separation was lost. Then, enter the vertical distance that existed between the aircraft at the time of that smallest lateral/longitudinal distance.

***EXAMPLE**- At one point two aircraft came within 2.8 miles and 400 feet of each other at the same time. The 400 feet was the smallest vertical distance between the aircraft during the incident. The same two aircraft continued their flight and came within 2.34 miles and 800 feet of each other at the same time; 2.34 miles being the smallest lateral distance between the aircraft during the incident. The proper entry would be "2.34" for lateral and "0800" for vertical.*

For situations where lateral/longitudinal distance was constant, enter that constant lateral/longitudinal distance and the smallest vertical distance between the aircraft.

***EXAMPLE**- Two aircraft were 2 miles apart on parallel routes, one at seven thousand feet and one at six thousand feet. The aircraft at seven thousand feet was cleared to descend to five thousand feet. The vertical distance decreased until the aircraft were at the same altitude, then increased until the descending aircraft leveled at five thousand feet. Enter "2.00," which was the constant (and smallest) lateral distance between the aircraft and "0" which was the smallest vertical distance.*

VERTICAL- Enter the vertical distance measured in feet.

EXAMPLE*- One foot would be entered as "0001," 100 feet would be entered as "0100," and 1,000 feet would be entered as "1000."*

LATERAL- Select "feet," "miles," "minutes," or "N/A" then enter the appropriate lateral distance.
EXAMPLE*- Two thousand feet would be entered as "2000," 2.34 miles would be entered as "2.34," and 4 minutes would be entered as "4."*

Block 9 - NUMBER OF AIRCRAFT FOR WHICH THE CONTROLLER HAD CONTROL RESPONSIBILITY AT THE TIME OF THE INCIDENT

Enter the number of aircraft for which the controller had separation responsibility, including point outs even though the aircraft may be on another frequency. For incidents involving tower cab local controllers, do not count aircraft waiting in line for departure unless the controller was responsible for their separation.

Block 10 - WAS TRAINING IN PROGRESS?

Select "Yes" or "No" to indicate if, at the time of the incident, training was being conducted at the position where the incident took place. **Blocks 11 through 36 shall be completed for <u>each</u> employee identified as primary or contributory to the incident.**

Block 11 - ENTER P FOR PRIMARY OR C FOR CONTRIBUTORY

Indicate whether the employee was the primary cause of the incident or contributed to the incident by entering a "P" for primary or "C" for contributory. One employee should be designated as the primary employee responsible for the incident. If a facility is unable to identify one employee as primary, mark all employees' with a "C" and include justification for the designation in Block 70, Facility Manager's Recommendations and Corrective Actions. Do not include employees' who were receiving OJT at the time of the incident.

Block12 - NUMBER OF PERSONNEL INVOLVED
This is the total number of personnel involved in the error or deviation at the facility that completes this report. This number will be automatically inserted in this block depending on the number of employees' for whom data is provided.

Block 13 - EMPLOYEE IDENTIFIER/FACILITY

EMPLOYEE IDENTIFIER: This letter will be automatically placed in the block for each employee for whom data is provided.

EMPLOYEE FACILITY IDENTIFICATION: Enter the three-letter identifier of the facility where the employee worked at the time of the incident.

EMPLOYEE FACILITY LEVEL: Select the classification level of the facility where the employee worked at the time of the incident. Select from levels 1 through 5.

EMPLOYEE FACILITY TYPE: Select the type of facility where the employee worked at the time of the incident. Select from, "CENTER," "FLIGHT SERVICE," "TOWER," "TRACON," or "OTHER."

Block 14 – EMPLOYEE IDENTIFIER

Enter the employees' identifier.

Block 15 - DATE OF BIRTH

Enter the month, day, and year of the employees' birth.

EXAMPLE*- A birth date of September 30, 1949 would be entered as "09/30/1949."*

Block 16 - SOCIAL SECURITY NUMBER

Enter the last SIX numbers of the employees' social security number.

Block 17 - INDICATE THE PERFORMANCE LEVEL OF THE EMPLOYEE
Select the position or the performance level of the employee at the time of the incident. Select "DEVELOPMENTAL," "CPC," "SUPERVISOR," "STAFF SPECIALIST," or "OTHER."
If "CPC" is selected, enter, as of the date of the incident, how many years and months the employee has been a CPC in the facility where the incident occurred.

EXAMPLE*- 5 years and 8 months would be entered as "05-08."*

Block 18 - LAST DATE OF CERTIFICATION OR RECERTIFICATION ON POSITION

DATE: Enter the most recent of either the date that the employee was initially certified or the last date that the employee was recertified on the position that he/she was staffing at the time of the incident.

EXAMPLE*- A date of May 25, 1993 would be entered as "05/25/1993."*

CERTIFICATION: Indicate whether the date entered is the initial certification date by selecting "I" or recertification be selecting "R."

Block 19 - HAS TRAINING BEEN RECEIVED WITHIN THE LAST 12 MONTHS THAT IS RELEVANT TO THE INCIDENT?

Select "Yes" or "No" to indicate whether the employee has

received training within the 12 months prior to the incident that is relevant to the incident. If "Yes" is selected, list the type and date of the training in the provided text box.

*** Block 20 - IS A MEDICAL CERTIFICATION ISSUE RELATED TO THE INCIDENT?**

Select "Yes" or "No" to indicate if a medical certification issue was related to the incident.

If "Yes" is selected, provide a complete explanation of how the medical certification issue related to the incident in Block 65, Summary of Incident.

Block 21 - IDENTIFY AND DESCRIBE THE TYPE OF WORK SCHEDULE BEING WORKED AT THE TIME OF INCIDENT

EXAMPLE*- When the employee is on an alternate work schedule always enter "AWS" before describing the shift. For example, an AWS shift of eight 9-hour days and one 8-hour day per pay period would be entered as "AWS 5-4/9." An AWS shift working four 10-hour days per week would be entered as "AWS 4/10."*

When the employee works 8-hour shifts; 2 days, 2 swings, 1 mid per week, enter "2-2-1." Explain any other schedules such as: "8 hour day shifts," "8 hour mid shifts," or "No standard operational work schedule, person on detail."

Supervisors, managers, or staff specialists who are maintaining currency but not working traffic full time should be described as: "First-level supervisor/area manager/air traffic manager/staff specialist maintaining currency."

Block 22 - CURRENT AND PREVIOUS SHIFT

Enter local times using the 24-hour clock.
PREVIOUS SHIFT: Enter the sign-in and sign-out times of the employee for the shift immediately prior to the shift on which the incident occurred. Enter these times ONLY if that shift ended less than 36 hours from the beginning of the shift on which the incident occurred. If the previous shift ended more than 36 hours before the shift on which the incident occurred, enter "N/A."

CURRENT SHIFT: Enter the sign-in and sign-out times for the employee for the shift on which the incident occurred.

Block 23 - AREA OF SPECIALIZATION

Enter the employees' area of specialization.

EXAMPLE*- Area B, Tower, TRACON, South Area, Tower/TRACON.*

Block 24 - SECTOR OR POSITION

Enter the sector or position that the employee was staffing at the time of the incident.

EXAMPLE*- Sector 34, Blueridge Sector, BKW, Sector OC9, South Arrival Radar, Arrival Radar 1, and Local Control One.*

Block 25 - TIME ON POSITION

Enter the amount of time in minutes the employee had been on the position at the time of the incident.

Block 26 - WHAT SECTORS OR POSITIONS WERE COMBINED AT THE POSITION BEING STAFFED BY THE CONTROLLER AT THE TIME OF THE INCIDENT?

List any other sectors or positions that were combined at the sector or position that the controller was staffing at the time of the incident.

EXAMPLE*- If the hand-off position of Sector 34 was combined at the radar position of Sector 34 that was being worked by the primary controller, enter "H34." If the North Feeder radar position was combined at the South Feeder radar position, enter "North Feeder Radar." A midnight watch would probably have several sectors/positions combined.*

Block 27 - WHICH ASSOCIATED POSITIONS WERE STAFFED AT THE TIME OF THE INCIDENT?

List any associated positions that were staffed at the time of the incident. These are positions that directly work with or assist the position being worked by the primary controller.

EXAMPLE*- If D34 was staffed at the time of incident when the primary controller was working R34, enter "D34." If the handoff position for Arrival Radar 1 was staffed, enter "Handoff Arrival Radar 1."*

Block 28 - POSITION FUNCTION

Select the employees' position function **at the time** of the incident from the following choices. Area Supervisor, Radar, Handoff, Radar Associate, Local Control, Ground Control, Clearance Delivery, Departure Position, Arrival Position, Air Traffic Assistant, Traffic Management, Flight Data, or Other.

If "Other" is selected, enter that function in the appropriate space.

EXAMPLE*- If the employee involved is an Area Supervisor but he/she was working a radar position at the time of the incident, enter an "R." If the employee was a staff specialist working the Controller-In-Charge position, enter "CIC."*

*** Block 29 - DID THE EMPLOYEE REQUEST ASSISTANCE PRIOR TO THE INCIDENT?**

Select "Yes" or "No" to indicate if the employee requested assistance prior to the incident. If "Yes" is selected, provide

an explanation of the request, to whom it was directed, any action or inaction that resulted based upon the request, etc., in the Block 65.

*** Block 30 - WAS THE EMPLOYEE AWARE THAT AN OPERATIONAL ERROR/DEVIATION WAS DEVELOPING?**

Select "Yes" or "No" to indicate if the employee was aware that an OE/OD was developing. In either case, provide an explanation in Block 65. If "Yes" is selected, explain the surrounding circumstances in relation to when the employee was aware. If "No" is selected, explain why the employee was unaware.

*** Block 31 - DID THE EMPLOYEE CONTEMPLATE TAKING CORRECTIVE ACTION?**

Select "Yes" or "No" to indicate if the employee contemplated taking any corrective actions regarding the incident. In either case, provide an explanation in 65.

If "Yes" is selected, explain what the employee thought of doing to correct the situation. If "No" is selected, explain why the employee did not think of taking corrective action.

*** Block 32 - DID THE EMPLOYEE ATTEMPT TO TAKE CORRECTIVE ACTION?**

Enter "Yes" or "No" to indicate if the employee attempted to take corrective action regarding the incident. In either case, provide an explanation in Block 65. If "Yes" is selected, explain what action was taken. If "No" is selected, explain why no corrective action was attempted.

Block 33 - EMPLOYEE WAS ALERTED TO THE INCIDENT BY

Enter the <u>first</u> source that alerted the employee of the incident by selecting one of the following: Conflict Alert, MSAW/EMSAW, Self-identified, Facility Personnel, Pilot, Another Facility, or Other. If "Other" is selected, describe the source in the appropriate space.

Block 34 - DATE AND TIME EMPLOYEE BECAME AWARE OF THE INCIDENT

Using the 24-hour clock, indicate the local date and time the employee became occurred even if it was not clear at the time that the incident was an error or deviation.

Block 35 - WAS THE DISTANCE REFERENCE (e.g., THE J-RING) BEING USED?

This block applies <u>only</u> to ARTCC's. Select "Yes" or "No" to indicate if, at the time of the incident, the "J-ring" (HALO) was being used on at least one aircraft involved in the incident.

*** Block 36 - WERE THERE ANY DISTRACTIONS OR ENVIRONMENTAL CONDITIONS THAT MAY HAVE INFLUENCED THE INCIDENT?**

Select "Yes" or "No." If "Yes" is selected, explain in Block 65. The explanation may include reference to conditions such as construction, equipment installation, presence of visitors, loud or boisterous co-workers, equipment malfunction, or extraneous conversation with co-workers or Environmental: ambient air, work area layout, temperature, noise, or lighting.

Block 37 - NAME THE OSIC/CIC ASSIGNED AT THE TIME OF THE INCIDENT

Enter the last name, first name, middle initial and last six numbers of social security number of the employee assigned as the Operational Supervisor-in-Charge (OSIC)/CIC of the operational area, at the time of the incident.

*** Block 38 - WAS THE ASSIGNED OSIC/CIC PRESENT IN THE OPERATIONAL AREA AT THE TIME OF THE INCIDENT?**

Select "Yes" or "No" to indicate if the OSIC/CIC was present in the operational area at the time of the incident.

If "No" is selected, provide an explanation in Block 65.

Block 39 - DID THE EMPLOYEE REQUIRE OSIC/CIC ASSISTANCE PRIOR TO THE INCIDENT?

This block should be completed using input from the OSIC/CIC assigned to the operational area, at the time of the incident.

Select "Yes" or "No" to indicate if assistance that is normally provided by the OSIC/CIC could have helped the employee to prevent the incident.

*** Block 40 - DID THE ASSIGNED OSIC/CIC PROVIDE ASSISTANCE?**

Select "Yes" or "No" to indicate if the assigned OSIC/CIC provided assistance to the employee that was pertinent to the incident. If "Yes" is selected, explain in Block 65 what assistance was provided. If "No" is selected, explain in Block 65 why assistance pertinent to the incident was not provided by the OSIC/CIC.

Block 41 - IF SECTORS WERE COMBINED, DID THE OSIC/CIC APPROVE THE COMBINATION?
For those facilities that have sectors, select "NOT COMBINED," "NO," or "YES" as appropriate.
For those facilities that <u>do not</u> have sectors, select "N/A."

Block 42 - IF POSITIONS WERE COMBINED, DID THE OSIC/CIC APPROVE THE COMBINATION?

Select "NOT COMBINED," "YES," or "NO," to describe the combination of positions.

Block 43 - IN WHAT ACTIVITY WAS THE ASSIGNED OSIC/CIC ENGAGED AT THE TIME OF THE INCIDENT?

Select the activity that most describes what the OSIC/CIC assigned to supervise the operation was doing at the time of the incident. If "Other" is selected, describe the activity as briefly as possible.

"General Supervision" means the OSIC/CIC was not engaged in direct operational supervision at the time of the incident. However, he/she was in the area, perhaps dealing with paperwork, phone calls, weather displays, equipment matters, etc.

"Direct operational supervision" means the OSIC/CIC was observing control positions and providing guidance and/or direction to controllers.

Block 44 - WAS THE OSIC CERTIFIED IN THE AREA OF SPECIALIZATION WHERE THE INCIDENT TOOK PLACE?

If an OSIC was assigned, at the time of the incident, to supervise the area of operation where the incident took place, select either "Yes", "No." A selection of "Yes" means that the OSIC was certified to work at least one operational control position in the area of specialization, at the time of the incident.

If "No" is selected, provide an explanation in this block of why the assigned OSIC was not certified to work at least one operational control position in the area of specialization, at the time of the incident.

Select "N/A" if an OSIC was not assigned, at the time of the incident, to supervise the area of operation where the incident took place.

Block 45 - TRAFFIC COMPLEXITY

Select 1 through 5 on the scale to indicate the level of traffic complexity at the time of the incident. One indicates a low level of complexity, 3 indicate an average level of complexity, and 5 indicate a high level of complexity.

When determining the traffic complexity, consider the overall difficulty of the controller's task; e.g. weather, variety of aircraft, traffic volume, coordination requirements, runway configuration, emergency situations, arrival/departure flows, etc.

*** Block 46 - INDICATE WHICH FACTOR (S) WERE ASSOCIATED WITH TRAFFIC COMPLEXITY**

Select the factor(s) that determined the level of traffic complexity at the time of the incident. If any of the factors were pertinent to the incident, provide an explanation in Block 65.

Block 47 - TYPE OF CONTROL PROVIDED

Select the type of control that was being provided at the position at the time of the incident. Select "RADAR," "TOWER," "OCEANIC," or "NONRADAR."

Block 48 - REQUIRED SEPARATION WAS BY
Select the appropriate document that specified the required separation concerning the incident. Select either "FAA ORDER," or "FACILITY LETTER OF AGREEMENT OR DIRECTIVE."

If "FAA ORDER" is selected, enter the order number and applicable paragraph number.

If "FACILITY LETTER OF AGREEMENT OR DIRECTIVE" is selected, enter the facility with which the LOA has been negotiated or the facility directive and paragraph numbers.

Block 49 - WERE ANY DEFICIENT PROCEDURES NOTED AS A RESULT OF THE INCIDENT?

Select "Yes" or "No" to indicate if any national, regional, or local procedures were found to be deficient as a result of the incident. If "Yes" is selected, provide an explanation in this block.

Block 50 - WERE ANY SPECIAL PROCEDURES IN EFFECT AT THE TIME OF THE INCIDENT?

Select "Yes" or "No" to indicate if any pertinent special procedures were in effect at the time of the incident. If "Yes" is selected, provide an explanation in this block.

For example, if a special military operation was pertinent to the incident, identify the operation and explain how it was pertinent. If unusual runway or airspace configurations were pertinent to the incident, describe those configurations and explain their pertinent relationship to the incident.

Block 51 - NUMBER OF AIRCRAFT INVOLVED IN THE INCIDENT

This number will automatically be entered as data for each aircraft is entered.

Blocks 52 through 58 shall be completed for each aircraft/vehicle identified as involved in the incident.

Block 52 - IDENTIFICATION

Enter the aircraft identity using combinations not to exceed 7 alphanumeric characters

Block 53 - PREFIX/TYPE/SUFFIX

Enter the aircraft prefix/type/suffix using combinations not to exceed 9 alphanumeric.

EXAMPLE*- A heavy Boeing 747 with TCAS, RNAV, and a transponder with altitude encoding capability would be entered as "B/B747/R."*

Block 54 - FLIGHT PROFILE OR VEHICLE POSITION AT TIME OF INCIDENT

Select the flight profile that best describes the aircraft before the incident. This should be the profile that was in effect before any action was taken to resolve the potential incident.

For example, an aircraft was in level flight when the controller saw the potential conflict. The controller then climbed the aircraft to maintain separation, but that action was not enough and separation was lost. Select "LEVEL FLIGHT" in this block for this scenario. The same would apply to vectors given to resolve the situation.

Select "OTHER" if the most appropriate profile is not listed and describe that profile in the text field. When more than one of the profile choices applies, make one selection then select "OTHER" and describe the other profile(s) in the text field.

Block 55 - AIRCRAFT GROUND SPEED

Enter the aircraft ground speed, in knots, at the time of the incident. Select "N/A" if the aircraft was on the ground at the time of the incident.

Block 56 - TCAS EQUIPPED

Select "Yes", "No", or "Unknown" to indicate if the aircraft was equipped with an operating TCAS at the time of the incident.

Block 57 - EVASIVE ACTION

Select "Yes", "No", or "Unknown" to indicate if the aircraft took any evasive action with regard to the incident. Chose "TCAS" if a pilot responded to a resolution advisory and climbed or descended.

EXAMPLE*- An aircraft inadvertently vectored close to another aircraft at the same altitude turns out of the path of that aircraft.*

Block 58 - DID THE PILOT FILE A NEAR MIDAIR COLLISION REPORT?

Select "Yes", "No", or "Unknown" to indicate if the pilot filed a near midair collision report.

Block 59 - AIRCRAFT AND OBSTRUCTION/OBSTACLES

If the incident involved aircraft and an obstruction or obstacle that contributed to the cause of the incident, select the appropriate item. If "Airport Movement Area" or "Other" is selected, explain in the text field.

Block 60 - WAS EQUIPMENT LAYOUT OR DESIGN A FACTOR IN THE INCIDENT?

Select "Yes" or "No" to indicate if equipment layout or design influenced the incident. If "Yes" is selected, provide an explanation in Block 65.

*** Block 61 - WAS ANY PERTINENT EQUIPMENT OPERATED BY THE CONTROLLER (S) REPORTED AS FUNCTIONING UNSATISFACTORILY BEFORE THE INCIDENT?**

Select "Yes" or "No" to indicate if any problems with pertinent equipment were reported by the controller prior to the incident. These are problems with equipment that existed before and during the incident. If "Yes" is selected, provide an explanation in Block 65.

Block 62 - SYSTEM(S) IN USE

Select the system(s) in use at the position where the incident occurred at the time of the incident.

Block 63 - WAS RADAR TRANSITION FROM ONE SYSTEM TO ANOTHER IN PROGRESS?

Select "Yes" or "No" to indicate if a radar transition from one system to another was in progress at the time of the incident. If "Yes" is selected, explain the circumstances of the transition in this block.

Block 64 - WHAT WAS THE STATUS OF THE CONFLICT ALERT AT THE TIME OF THE INCIDENT?

Select the status that best describes the status of the conflict alert feature at the position where the incident occurred at the time of the incident.

Block 65 - SUMMARY OF INCIDENT

Explain, in chronological order, each factor relevant to the incident.

Tell a detailed story, describing the pertinent actions of all those involved (e.g. controllers by position, supervisors, aircraft, etc.). It should be apparent what actions (of lack of) contributed to or caused the incident. Include any explanations necessary from previous blocks.

Refer to aircraft using their call signs and to individuals by position or title, as appropriate. For example, use "UAL1065" instead of "Aircraft #1." Use "R34" or "Local Control" instead of "Controller A." The summary should be complete so that the reader does not have to refer back to other blocks for information on controller positions, aircraft identifications, etc.

REFERENCE *specific times only when it is necessary to better describe the order of events. Use local times so the reader can better understand the time of day the events took place.*

End the summary with a short (usually 4-5 lines) recap of the specific reasons the incident occurred. Explain why the controller did not maintain separation.

EXAMPLE-

a. The controller may have been focusing on another situation and when he/she noticed the potential incident it was too late to maintain separation.

b. The controller issued a clearance but by the time he/she noticed the aircraft was not complying fast enough it was too late to maintain separation.

c. A readback/hearback error occurred and the controller did not have enough time to issue the correct clearances to maintain separation.

d. The controller thought the heading/climb/descent he/she gave an aircraft would maintain separation but by the time it was apparent that separation would be lost, it was too late for more effective instructions to take effect.

e. Equipment failure did not allow the controller to issue the necessary timely instructions.

f. An authorized local/regional/national procedure was followed correctly but an OE/OD still resulted.

NOTE:
A phrase such as "The controller failed to establish vertical separation before lateral separation was lost" is not appropriate. It is a factual statement but it does not describe the specific circumstances surrounding the incident or why the controller failed to maintain separation.

Block 65 - SUMMARY OF INCIDENT EXAMPLE

AAL1045, B757, was eastbound at FL290 from over LIN direct OAL en route to JFK and in communication with R25. UAL432, DC10, was westbound at FL350 from approximately over OAL direct MOD, en route to SFO, and in communication with R12. The aircraft were on approximately opposite direction courses.

At 0923:15, R12 accepted the hand-off on AAL1045 and requested D12 to coordinate with Sector 25 to assign AAL1045 a heading of 120 degrees and to climb the aircraft to FL370. D12 then contacted R25 with the requests and R25 issued AAL1045 the coordinated clearances. The pilot acknowledged both the heading and the altitude clearance.

At 0924:05 the R25 controller requested help at the sector due to traffic volume (15 aircraft and increasing) and flow restrictions, due to weather, requiring a 20 mile-in-trail restriction for aircraft landing SFO. The OSIC had a controller working on the "D" position at Sector 25 within 3 minutes of the request.

At 0925:30, R25 accepted the hand-off on UAL432, which was converging with AAL1045. The DART data showed that AAL1045's altitude was FL316. The aircraft were 72 miles apart.

At 0927:50, the R25 controller generated a HALO around UAL432 radar target and, simultaneously, the Conflict Alert activated. Three seconds later UAL432 made initial contact with R25, at FL350. Lateral separation was then 39 miles with AAL1045 climbing through FL342. Immediately following UAL432's initial contact, the R25 controller issued UAL432 a 20-degree right turn. The pilot acknowledged.

At 0928:05, the R25 controller issued AAL1045 a right turn to heading 140 degrees and asked the pilot to "give me a good rate of climb". The pilot acknowledged. The R25 controller then returned to UAL432 and issued a right turn to 310 degrees and the pilot acknowledged. The R25 controller thought that the vectors given were adequate to maintain lateral separation so that AAL1045 could continue to climb through the altitude of UAL432. Approximately 20 seconds passed and at 0928:45 the R25 controller asked UAL432 if he had started his turn. The pilot's response was, "We see the traffic out in front of us." The R25 controller stated that he needed UAL432 to start the turn "immediately." The pilot stated that he was turning and passing through "three zero". Though not yet evident to the R25 controller, the turn had been started at or before 09:28:40, as indicated by NTAP data.

At 0929:04 separation was lost. The NTAP indicated 3.9 miles lateral and 200 feet vertical separation as the closest proximity.

Although the R25 controller accepted a handoff on UAL432 knowing of the route convergence with AAL1045, he thought that AAL1045's initial vector and the 310 degrees heading he assigned to UAL432 would maintain separation. He could have amended AAL1045's altitude to FL330 during the climb to maintain vertical separation or could have given sharper turns to both aircraft to achieve lateral separation. By the time he recognized that the vectors were not working, it was too late to maintain separation.

Block 66 - INVESTIGATORS

Enter the dates the investigators reviewed the report. Investigators shall sign in the appropriate places to indicate they have reviewed the completed report.
Entering a date in the appropriate space will cause a "/s/" to be automatically entered in the associated signature space when printed.
The page with the original signature(s) shall be retained at the facility with the rest of the report. Copies of this page may contain a copy of the signature(s) or an "/s/" in the signature space(s).

PART II - Facility Manager Action

GENERAL INFORMATION

The facility manager's signature indicates that he/she has reviewed and concurs with the data submitted by the IIC and the investigative team (if applicable), and is satisfied that Part I of the final report is complete and sufficient to determines the following:

a. The determination that the incident is an operational error or operational deviation.

b. The category (ies) of the operational error/deviation and the reasons for category determination.

c. Recommendations and actions to be taken to prevent a recurrence of the incident.

d. The causal factor(s) of the incident.

Block 67 - SELECT THE CATEGORY OF THE OPERATIONAL ERROR/DEVIATION

Select the category or categories that best describe(s) the cause(s) of the incident.

Select "ATCS" if one or more of the following is identified as either a causal or contributing factor:

a. An ATCS fails to adhere to procedures in or acts according to an individual misinterpretation of Orders 7110.65, 7110.10, or supplemental instructions.

b. An ATCS demonstrates substandard performance not covered in a, above.

Select "MANAGER/SUPERVISOR/OTHER PERSONNEL" when an action or inaction of a manager(s), supervisor(s), or other personnel is identified as a causal or a contributing factor to the incident.

NOTE:
This category should not be used for an OE/OD involving a manager, supervisor, or other personnel performing regular ATCS duties, e.g., working an operational position for shift coverage, or currency time. Such incidents should instead be categorized as "ATCS."

Select "PROCEDURAL" if an established procedure was the primary cause or contributed significantly to the cause(s) of the incident. Do not complete blocks 14-18 for errors categorized as “PROCEDURAL”.

Select "EQUIPMENT" if equipment failure was the primary cause or contributed significantly to the cause(s) of incident. Do not complete blocks 14-18 for errors categorized as “EQUIPMENT”.

Block 68 - CAUSAL FACTORS

Under each column designated for a specific employee, select any box so that an "X" appears, when the description identifies a causal factor of the incident.

EXAMPLE*- If overlapping data blocks were a causal factor of the incident and it was employee "A" who was associated with the overlapping data blocks, select the box in column "A" under section B (1) entitled "Overlapping data blocks." If a causal factor of the incident was the employees’ failure to coordinate correctly with a position within the same sector, select the box on the line in sector E (1) entitled "Intra-position."*

If "Other" is selected, in any section and more room is needed for the explanation, use Block 65, Incident of Summary.

SECTION A: DATA POSTING

A data posting error is any error of calculation, omission, or incomplete data, erroneous entries, handling, or subsequent revisions to this data. This includes errors in posting and recording data. It does not include errors involved in receiving, transmitting, coordinating, or otherwise forwarding this information. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

SECTION B: RADAR DISPLAY

a. Misidentification

Radar misidentification means a failure to properly identify the correct target and includes subsequent errors committed after the original identification was properly accomplished. Indicate the listed item(s), which most closely describes the reason for misidentification. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

b. Inappropriate Use of Displayed Data

A data or display information error occurs due to a failure to maintain constant surveillance of a flight data display or traffic situation and to properly use the information presented by the display or situation. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

SECTION C: AIRCRAFT OBSERVATION (Towers Only)

An aircraft observation error means a failure to maintain constant surveillance of aircraft and the movement area, and to properly react to, interpret, or otherwise utilize, in a timely manner, the information being viewed. If one of the

causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

SECTION D: COMMUNICATIONS ERROR

A communications error is a causal factor associated with the exchange of information between two or more people (e.g., pilots and specialists). It refers to the failure of human communication not communications equipment.

a. Phraseology

Use of incorrect or improper phraseology.

b. Transposition

An error due to transposition of words, numbers, or symbols by either oral or written means. This involves writing/saying one thing while thinking/hearing something else.

c. Misunderstanding

The failure to communicate clearly and concisely so that no misunderstanding exists for any actions contemplated or agreed upon.

d. Read back

The failure to identify improper or incorrect read back of information.

e. Acknowledgment

The failure to obtain or give an acknowledgment for the receipt of information.

f. Other

If the causal factors listed above do not adequately describe the factor involved, list the factor and provide a brief explanation.

SECTION E: COORDINATION

Any factor associated with a failure to exchange requirement information. This includes coordination between individuals, positions of operation, and facilities for exchange of information such as APREQ's, position reports, forwarding of flight data, etc. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

SECTION F: POSITION RELIEF BRIEFING

Relief briefing errors are special errors of both communication and coordination, which occur as the result of position relief. They include such things as failure to give a relief briefing, failure to request a briefing, incomplete or erroneous briefing, etc. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

Block 69 - FACILITY MANAGER'S RECOMMENDATIONS AND CORRECTIVE ACTIONS

List recommendations and/or corrective actions that have been taken or will be taken to prevent a recurrence of a similar OE or OD.

The facility manager should address any written comments from the involved employees' or the bargaining unit in this block.

The facility manager may use this block to explain the rationale behind any decisions or to comment on any part(s) of the investigation.

Record the local date (month/day/year) in the appropriate space that the facility manager, or his/her authorized representative, signed the report. Print or type the name of the facility manager in the appropriate space. The facility manager, or his/her authorized representative, shall sign in the appropriate space.

Entering a date in the appropriate space will cause a "/s/" to be automatically entered in the signature space when printed.

The page with the original signature shall be retained at the facility with the rest of the report. Copies of this page may contain a copy of the signature or an "/s/" in the signature space.

PART III - Air Traffic Division Manager

Block 70 - DIVISION MANAGER'S CONCLUSIONS AND RECOMMENDATIONS

If the ATD manager concurs with the recommendations and corrective actions taken by the facility manager, select the box at the top of the block so that an "X" appears in the box next to the sentence "We concur with the recommendations and corrective actions of the facility manager."

If the ATD manager does not concur with the recommendations and corrective actions taken by the facility manager, describe the differences of opinions. Record the local date (month/day/year) in the appropriate space that the division manager, or his/her authorized representative, signed the report. Print or type the name of the division manager in the appropriate space. The division manager, or his/her authorized representative, shall sign in the appropriate space.

Entering a date in the appropriate space will cause a "/s/" to be automatically entered in the signature space when printed. The page with the original signature shall be retained at the division with the rest of the report. Copies of this page may contain a copy of the signature or an "/s/" in the signature space.

APPENDIX B

Final Operational Error/Deviation Report

Report Number

PART I. INVESTIGATIVE DATA

1. Date and time of incident:
MM/DD/YYYY
Time (Local)

2. Responsible facility:

Classification level:

3. Severity Index: points

☐ Low
☐ Moderate
☐ High

☐ Controlled w/ no TCAS
☐ Controlled with TCAS RA
☐ Uncontrolled

☐ Converging, Opposite Courses
☐ Converging, Crossing Courses
☐ Same Course
☐ Diverging/Non-intersecting Courses

4. Was weather a factor in the incident? ☐ Yes ☐ No

(If yes, explain in the incident summary.)

5. Altitude/flight level of incident:

6. Type of airspace:

☐ Class A
☐ Class B
☐ Class C
☐ Class D
☐ Other
☐ Class E
☐ Class G
☐ Oceanic
☐ Airport surface

7. Location of incident:

Fix
Direction
Distance
Latitude
Longitude
Intersection
Runway
Taxiway

8. Closest proximity:

Vertical feet

Lateral

☐ Feet
☐ Miles
☐ Minutes
☐ N/A

9. Number of aircraft controller had control responsibility for at the time of the incident:

10. Was trainin in progress?

☐ *Yes*

☐ *No*

Complete blocks 11-36 for each employee

11. Enter P for Primary or C for contributory:

12. Number of personnel involved:

13. Employees' facility:

3-letter Identification

Level

Type

14. Employee identifier:

15. Date of birth:

MM/DD/YYYY

16: Social Security Number:

Last 6 digits only

17. Indicate the performance level of the employee:

☐ Developmental
☐ CPC
☐ Supervisor
☐ Staff Specialist
☐ Other

If CPC, how long since CPC in current facility?

YY-MM

18. Last date of certification or recertification on position:

☐ Initial Certification
☐ Recertification

19. Has training been received within the last 12 months that is relevant to the incident?

☐ Yes ☐ No

If yes, list the type and the date of that training in this block:

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20. Is a medical certification issue related to the incident?

☐ Yes

☐ No

(If yes, explain in the incident summary.)

21. Identify and describe the type of work schedule being worked at the time of the

22. Current and previous shift

Previous shift
Sign in Sign out

Current shift
Sign in Sign out

23. Area of specialization:

24. Sector or position:

Number and Name

25. Time on position:

Minutes

26. What sectors or position were combined at the position being staffed by the controller at the time of the incident?

27. Which associated positions were staffed at the time of the incident?

28. Position function:

☐ Radar ☐ Radar Associate ☐ Hand Off ☐ Local Control ☐ Ground Control

☐ Flight Data ☐ Clearance Delivery ☐ Departure Position ☐ Arrival Position ☐ Area Supervisor

☐ Air Traffic Assistant ☐ Traffic Management ☐ Tracker Other:

29. Did the employee request assistance prior to the incident?

☐ Yes ☐ No

(If yes, provide explanation in the incident summary.)

30. Was the employee aware that an operational error/deviation was developing?

☐ Yes ☐ No

(Provide explanation in the incident summary.)

31. Did the employee contemplate taking corrective action?

☐ Yes ☐ No

(Provide explanation in the incident summary.)

32. Did the employee attempt to take corrective action?

☐ Yes ☐ No

(Provide explanation in the incident summary.)

33. Employee was alerted to the incident by:

Equipment:
☐ Conflict alert
☐ MSAW/EMSAW

Personnel:
☐ Self-identified
☐ Facility personnel

Non-facility personnel:
☐ Pilot
☐ Another facility

Other:

34. Date and time employee became aware of the incident:

MM/DD/YYYY Time (local)

35. Was the Distance Reference Indicator (i.e., J-Ring) being used?

☐ Yes

☐ No

36. Were there any distractions or environmental conditions that may have influenced the incident?

☐ Yes ☐ No (If yes, provide explanation in the incident summary.)

(i.e., distractions: construction, equipment installation, presence of visitors, loud or boisterous coworkers, equipment malfunction, and extraneous Conversation w/coworkers; environmental: ambient air, work area layout, temperature, noise, and lighting.)

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Report Number

37. Name the OSIC/CIC assigned at the time of the incident:

Enter A for OSIC
Enter C for CIC

Last name First name MI SSN (Last 6 digits)

38. Was the assigned OSIC/CIC present in the operational area at the time of the incident?

☐ Yes ☐ No

39. Did the employee require OSIC/CIC assistance prior to the incident?

☐ Yes ☐ No

40. Did the assigned OSIC/CIC provide assistance?

☐ Yes ☐ No
(Provide explanation in the incident summary.)

41. If sectors were combined, did the OSIC/CIC approve the combination?

☐ Yes ☐ No ☐ Not combined ☐ N/A

42. If positions were combined, did the OSIC/CIC approve the combination?

☐ Yes ☐ No ☐ Not Combined

43. In what activity was the assigned OSIC/CIC engaged at the time of the incident?

☐ General Supervision ☐ Administering training
☐ Direct operational supervision ☐ Receiving training
☐ Working a position of operation ☐ Other

44. Was the OSIC/CIC certified in the area of specialization where the incident took place?

☐ Yes ☐ No ☐ N/A (If no, explain here)

45. Traffic complexity

1	2	3	4	5
Low		Avg		High

46. Indicate which factor(s) were associated with traffic complexity.

☐ Weather ☐ Runway configuration
☐ Terrain ☐ Runway condition
☐ Airspace configuration ☐ Flow control
☐ Number of aircraft ☐ Special event
☐ Experience level ☐ Other
☐ Emergency situation

47. Type of Control Provided

☐ Radar
☐ Tower
☐ Oceanic
☐ Nonradar

48. Required separation was by:

☐ FAA Order
☐ Facility Letter of Agreement (LOA) or Directive

FAA Order Facility LOA/Directive
Paragraph Paragraph

49. Were any deficient procedures noted as a result of the incident?

☐ Yes ☐ No
(If yes, explain here)

50. Were any special procedures in effect at the time of the incident? (e.g. Traffic Management Program)

☐ Yes ☐ No
(If yes, explain here)

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(Complete additional sections if more than two aircraft are involved)

51. Number of aircraft involved in the incident:

	Aircraft No. 1	Aircraft No. 2
52. Identification		
53. Prefix/type/suffix		
54. Flight profile or vehicle position at time of incident	☐ Descending ☐ Making approach ☐ Touching down ☐ Radar vector ☐ Level flight ☐ Takeoff roll ☐ Taxiing-runway ☐ Landing roll ☐ Climbing ☐ Holding in position on runway ☐ Other	☐ Descending ☐ Making approach ☐ Touching down ☐ Radar vector ☐ Level flight ☐ Takeoff roll ☐ Taxiing-runway ☐ Landing roll ☐ Climbing ☐ Holding in position on runway ☐ Other
55. Aircraft ground speed	☐ N/A knots	☐ N/A Knots
56. TCAS equipped	☐ Yes ☐ No ☐ Unknown	☐ Yes ☐ No ☐ Unknown
57. Evasive action	☐ Yes ☐ No ☐ TCAS ☐ Unknown	☐ Yes ☐ No ☐ TCAS ☐ Unknown
58. Did the pilot file a Near Midair Collision Report	☐ Yes ☐ No ☐ Unknown	☐ Yes ☐ No ☐ Unknown

59. Aircraft and Obstruction/Obstacles

☐ Terrain ☐ Vehicle(s) ☐ Personnel ☐ Obstruction ☐ Equipment ☐ Protected Airspace

☐ Airport Movement Area (explain) ☐ Not applicable ☐ Other (explain)

60. Was equipment layout or design a factor in the incident?

☐ Yes ☐ No (If yes, explain in the incident summary)

61. Was any pertinent equipment operated by the controller(s) reported as functioning unsatisfactorily before the incident?

☐ Yes ☐ No (If yes, explain in the incident summary)

62. System(s) in use:

☐ Narrowband	☐ ASR-9	☐ ASDE II	☐ STARS	☐ ARTS IIIA
☐ Broadband	☐ ASR-11	☐ ASDE III	☐ STARS on ARTS	☐ ARTS IIE
☐ DARC	☐ URET	☐ AMASS	☐ ACDs on ARTS	☐ ARTS IIIE
☐ CENRAP	☐ OASIS	☐ D-BRITE	☐ DSR	☐ EARTS
☐ Mode S	☐ Model1	☐ BRITE IV	☐ Other:	

63. Was radar transition from one system to another in progress?

☐ Yes ☐ No (If yes, explain here)

64. What was the status of the conflict alert at the time of the incident?

☐ Activated ☐ Not available ☐ Not activated

☐ Not installed ☐ Suppressed

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65. SUMMARY OF INCIDENT (continued from page 5)

66. INVESTIGATORS

Date	Typed/Printed Name	Signature
MM/DD/YYYY	First/Last Name	Investigator-in-Charge
MM/DD/YYYY	First/Last Name	Team Member
MM/DD/YYYY	First/Last Name	Team Member
MM/DD/YYYY	First/Last Name	Team Member
MM/DD/YYYY	First/Last Name	Team Member
MM/DD/YYYY	First/Last Name	Team Member
MM/DD/YYYY	First/Last Name	Team Member

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Part II. FACILITY MANAGER ACTION

67. Select the category of the operational error/deviation. (more than one category may be possible)

☐ Procedural ☐ Equipment ☐ ATCS ☐ Manager/Supervisor/Other Personnel

68. Causal Factors	No	Yes (employee) A	B	C	D	E
A. Data Posting	☐					
(1) Computer Entry	☐					
Incorrect input		☐	☐	☐	☐	☐
Incorrect update		☐	☐	☐	☐	☐
Premature termination of data		☐	☐	☐	☐	☐
Input/Update not made		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
(2) Flight Progress Strip	☐					
Not updated		☐	☐	☐	☐	☐
Interpreted incorrectly		☐	☐	☐	☐	☐
Posted incorrectly		☐	☐	☐	☐	☐
Updated incorrectly		☐	☐	☐	☐	☐
Premature removal		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
B. Radar Display	☐					
(1) Misidentification	☐					
Failure to reidentify aircraft when the accepted target identity becomes questionable		☐	☐	☐	☐	☐
Overlapping data blocks		☐	☐	☐	☐	☐
Acceptance of incomplete or difficult to correlate position information		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
(2) Inappropriate Use of Displayed Data	☐					
MODE C		☐	☐	☐	☐	☐
BRITE		☐	☐	☐	☐	☐
Conflict alert		☐	☐	☐	☐	☐
Failure to detect displayed data		☐	☐	☐	☐	☐
Failure to comprehend displayed data		☐	☐	☐	☐	☐
Failure to project future status of displayed data		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
C. Aircraft Observation (Towers Only)	☐					
(1) Actual Observation of Aircraft		☐	☐	☐	☐	☐
(2) Improper Use of Visual Data	☐					
Landing		☐	☐	☐	☐	☐
Taking Off		☐	☐	☐	☐	☐
Ground Operation	☐					
Taxiing across runway		☐	☐	☐	☐	☐
Holding in position for takeoff		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐

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	No	Yes (employee) A	B	C	D	E
D. Communication Error	☐					
(1) Phraseology		☐	☐	☐	☐	☐
(2) Transposition		☐	☐	☐	☐	☐
(3) Misunderstanding		☐	☐	☐	☐	☐
(4) Read back	☐					
Altitude		☐	☐	☐	☐	☐
Clearance		☐	☐	☐	☐	☐
Identification		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
(5) Acknowledgement		☐	☐	☐	☐	☐
(6) Other (explain)		☐	☐	☐	☐	☐
E. Coordination	☐					
(1) Area of Incident	☐					
Intra-sector/position		☐	☐	☐	☐	☐
Inter-sector/position		☐	☐	☐	☐	☐
Inter-facility		☐	☐	☐	☐	☐
Facility type: , level: , and facility ID:		☐	☐	☐	☐	☐
(2) Failure to utilize/comply with precoordination information		☐	☐	☐	☐	☐
(3) Improper use of information exchanged in coordination	☐					
Aircraft Identification		☐	☐	☐	☐	☐
Altitude/Flight Level		☐	☐	☐	☐	☐
Route of Flight		☐	☐	☐	☐	☐
Speeds		☐	☐	☐	☐	☐
APREQs		☐	☐	☐	☐	☐
Special Instructions		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
(4) Failure to coordinate between ground and local control	☐					
Crossing active runway		☐	☐	☐	☐	☐
Vehicle, equipment, or personnel on active runway		☐	☐	☐	☐	☐
Use of other than active runway for arrival and departures		☐	☐	☐	☐	☐
Runway closure		☐	☐	☐	☐	☐
Other (explain)		☐	☐	☐	☐	☐
F. Position Relief Briefing	☐					
(1) Employee did not use position relief checklist		☐	☐	☐	☐	☐
(2) Employee being relieved gave incomplete briefing		☐	☐	☐	☐	☐
(3) Relieving employee did not make use of pertinent data exchanged at briefing		☐	☐	☐	☐	☐
(4) Other (explain)		☐	☐	☐	☐	☐

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69. FACILITY MANAGER'S RECOMMENDATIONS AND CORRECTIVE ACTIONS

Date	Typed/Printed Name of Facility Manager	Signature

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Part III. AIR TRAFFIC DIVISION MANAGER

70. AIR TRAFFIC DIVISION MANGER'S CONCLUSIONS/RECOMMENDATIONS

☐ We concur with the recommendations and corrective actions of the facility manager.

Date	Typed/Printed Name of Division Manager	Signature

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